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FM 55-8

DEPARTMENT OF THE ARMY FIELD MANUAL

TRANSPORTATION INTELLIGENCE

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HEADQUARTERS, DEPARTMENT OF THE ARMY
DECEMBER 1961

FIELD MANUAL

No. 55-8

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., 6 December 1961

TRANSPORTATION INTELLIGENCE

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* This manual supersedes FM 55-8, 12 October 1956, and DA Forms 55-170, 55-171, 55-172, 55-173, 55-174, 55-175, 55-176, 55-177, 55-178, 55-179, 55-180, 55-181, 55-182, 55-183, 55-184, and 55-185.

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CHAPTER 1

GENERAL

1. Purpose and Scope

a. This manual explains how transportation intelligence is produced, disseminated, and used. It is a training and planning guide for personnel concerned with transportation information and intelligence.

b. The transportation intelligence responsibilities and functions of transportation officers, transportation staff sections, and transportation units are explained. The organization for collecting information and producing transportation intelligence is discussed. The fundamentals of collecting and processing information and of disseminating and using transportation intelligence are explained. Source references for transportation intelligence and related subjects are listed in appendix I. Information requirements and possible foreign sources of information for each mode of transportation are outlined in appendixes II through VII. Appendix VIII consists of sample intelligence photographs, which show how transportation facilities and equipment should be photographed. Sample reporting formats are shown in appendix IX; transportation terms are defined in appendix X. Procedures described herein are in accord with accepted Department of the Army doctrine and apply to all echelons of command. (FM 30-16 prescribes the overall responsibilities and organization for the production of technical intelligence.)

c. The material presented herein is applicable without modification to both nuclear and nonnuclear warfare.

d. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to the Commandant, U.S. Army Transportation School, Fort Eustis, Va.

2. Function

a. Definition. Transportation intelligence is the product resulting from the collection, evaluation, interpretation, analysis, and integration of all available information about the air, land, and water transportation systems of foreign areas of operations that are of immediate or potential military significance. This intelligence includes data on the characteristics, condition, development, organization, materiel, operation, maintenance, and construction of transportation systems and facilities.

b. Role. Transportation intelligence is necessary when evaluating the feasibility of United States or enemy operations in a given area. It provides data essential to strategic, logistical, and tactical planning by—

- (1) Providing the Defense Department and other governmental agencies with intelligence about the physical characteristics of transportation systems and their allied activities.
- (2) Supporting the war planning schedule that is directed by the Joint Chiefs of Staff and implemented by the military departments and the unified and specified commanders overseas.
- (3) Furnishing commanders at all echelons with timely intelligence upon which to base their decisions.

c. Coordination. It is most important that a continuing and vigorous system of transportation intelligence liaison and coordination be maintained with other staffs, units, and agencies, at appropriate staff levels, under the supervision and within the policies of the Assistant Chief of Staff for Intelligence (ACSI). Coordination in areas of mutual interest precludes confusion and duplication of effort. Railway, motor transport, water terminal, and air terminal intelligence is also of major interest to the Corps of Engineers. The Quartermaster Corps is interested in some distribution facilities, such as pipelines and storage tanks for POL products. The Military Police Corps requires transportation intelligence dealing with motor transport traffic control and the physical security of such installations and facilities as bridges, tunnels, terminals, marshaling yards, and landing fields. The Signal Corps is concerned with telecommunications equipment and procedures for the control of traffic pertaining to all transportation modes. The Ordnance Corps is particularly interested in ordnance equipment used for transportation, especially that used for motor transport. Civil Affairs units and staffs are concerned with transportation information about the civil population.

CHAPTER 2

ORGANIZATION

3. General

Armywide organization for the collection of information, processing of collected information, and dissemination and use of the resulting technical intelligence about foreign facilities and materiel is prescribed in FM 30-16. This chapter discusses Transportation Corps organizational elements concerned directly with transportation intelligence activities in oversea areas. Organization in a theater of operations is shown in figure 1.

4. Transportation Officer and Staff

a. Transportation Officer. The transportation officer of a command, under the general staff direction and supervision of G2, has organizational elements that enable him to accomplish his transportation intelligence responsibilities. The transportation intelligence officer on his staff is directly concerned with performing this function.

b. Transportation Special Staff Section. The transportation special staff section in oversea commands normally includes a plans and intelligence division. This division has an intelligence branch, under the transportation intelligence officer, organized to carry out the intelligence duties and responsibilities of the transportation officer as defined in FM's 30-16 and 101-5.

5. Transportation Intelligence Teams

a. General. Under the general staff direction and supervision of G2, the transportation officer is responsible for the accomplishment of the assigned mission of TOE 55-500 transportation intelligence teams. In some instances these intelligence teams are the only specially trained transportation intelligence personnel available to a command. They assist the transportation officer to discharge his intelligence responsibilities, including liaison with transportation, engineer, signal, and other staff elements. They are his intelligence staff—planning, collecting, processing, and reporting information and maintaining intelligence. The trans-

portation corps has three types of intelligence teams; they are designated HA, HB, and HC. Each team is responsible for the performance of specialized transportation intelligence activities. The HA and HB teams are large teams; they have personnel representing all transportation modes. The HC team is a small one and is used to augment either of the other teams or to operate where large teams are not justified. The organization, capability, and normal assignment or attachment of each team are described below. Properly authorized and under the supervision of the appropriate staff transportation officer, teams or team personnel may be assigned or attached to any organization that needs them.

b. Team HA (Collection).

- (1) This team is capable of collecting and partially processing technical information and reporting information and any intelligence produced about physical characteristics, critical features, resources, condition, organization, operation, and performance of foreign transportation systems. The team also selects, processes, and expedites the flow of foreign transportation materiel for intelligence purposes.
- (2) One or more HA teams are normally assigned or attached to a corps, field army, or logistical command headquarters under supervision of the appropriate staff transportation officer. These teams may also be assigned or attached to an intelligence unit organized under TOE 30-600.

c. Team HB (Research).

- (1) This team is capable of producing and reporting technical intelligence concerning the physical characteristics, critical features, resources, condition, organization, operation, performance, and capacities of foreign transportation systems. The team selects, processes, and expedites the flow of foreign transportation materiel. It can also perform selected transportation information collection missions.
- (2) One or more of these teams are normally assigned to or attached to a theater, theater army headquarters, field army headquarters or logistical command headquarters under supervision of the appropriate staff transportation officer. Teams may also be assigned or attached to an intelligence unit organized under TOE 30-600.

d. Team HC (Augmentation).

- (1) Although limited in personnel, this team's capabilities are similar to those of the HA team.

- (2) The HC team normally is assigned or attached to an HA or HB team as augmentation or to a command or theater if the assignment of a larger team is not justified. It may also be assigned or attached to an intelligence unit organized under TOE 30-600.

6. Division Transportation Officer

The transportation officers of the infantry and armored divisions and the transportation officer (an assistant to the Assistant Chief of Staff, G4) of the airborne division have the same general intelligence functions as transportation officers of higher echelons. Their functions are subject to such modifications as may be directed by their division commanders. See FM 30-16 for detailed information.

CHAPTER 3

RESPONSIBILITIES

7. General

The collection of transportation information and the production and dissemination of transportation intelligence are command responsibilities. The transportation officer assists the commander in the discharge of these responsibilities. In this text, the term "transportation officer" refers to the transportation special staff officer at each level of command outside the continental United States, including the transportation officer of a combat division. At all echelons, the G2 is responsible for technical intelligence coordination and is the initial point of contact with non-Army agencies—civil, military, domestic, and foreign. In addition, he is responsible for integrating and coordinating the collection effort of all technical intelligence agencies within the command, including those of the technical services. Unnecessary duplication of effort will result unless coordination is effected between all concerned because the other technical services, G2's of all commands, other Army agencies, elements of the Navy and Air Force, and others also collect and report transportation information and/or intelligence.

8. Individual Responsibilities

The individual responsibilities outlined in the following subparagraphs are general in nature. Detailed information requirements and collection procedures at the operating level are given in appendixes II through VII for each mode of transportation. Transportation personnel at all operating echelons should be thoroughly familiar with the information requirements that pertain especially to their mode of transport.

a. Intelligence Staff Officers. The Assistant Chief of Staff for Intelligence at Department of the Army level, directors of security, and G2's at lower echelons of command, with the assistance of technical intelligence coordinators, general and special staff officers, and technical specialists evaluate and interpret information in accordance with their established intelligence responsibilities and command directives. They produce intelligence in relation to

given operational situations to determine the capabilities and probable courses of action of hostile military forces. The responsibilities of the Assistant Chief of Staff for Intelligence and the technical services for technical intelligence about foreign facilities and materiel usable in military operations are prescribed in FM 30-16.

b. Chief of Transportation. The Chief of Transportation is responsible for—

- (1) Producing and maintaining worldwide transportation intelligence to service fully the basic and staff transportation intelligence needs of the Transportation Corps and the other technical services; the Department of the Army, Defense, State, and Commerce; the Central Intelligence Agency; and the joint task force commanders, army component commanders, and unified and specified commanders in oversea areas.
- (2) Providing training facilities and programs (ch. 4).
- (3) Performing the intelligence functions common to the chiefs of all technical services (FM 30-16).

c. Chief, Transportation Intelligence Agency. The Chief of the U.S. Army Transportation Intelligence Agency, a class II activity of the Chief of Transportation, assists the Chief of Transportation in carrying out his intelligence responsibilities by producing and maintaining the following types of transportation intelligence studies, estimates, and analyses.

- (1) The transportation sections of the National Intelligence Surveys provide, on a worldwide basis, a complete and comprehensive coverage of basic information about railroads, highways, inland waterways, ports and harbors, and aviation. These surveys contain technical data concerning physical characteristics, condition, critical features, and limiting factors (bridge and tunnel data are furnished by the Corps of Engineers), resources, performance data, and operating procedures of transportation modes. These are produced under the joint direction and supervision of the Assistant Chief of Staff for Intelligence, Department of the Army, and the Central Intelligence Agency. They assist other U.S. Government agencies in the development and execution of policies, plans, estimates, and decisions affecting national security, foreign policy, and the readiness posture of the Armed Forces.

- (2) Special transportation network analyses and military line-of-communication studies contain summary descriptions of ports, beaches, and road and rail nets, including their throughput capacities. They also describe airfields and give their runway bearing characteristics and capabilities.
- (3) Special studies, estimates, and analysis of foreign military transportation equipment (including rotary-wing and light fixed-wing aircraft), organizations, installations, scientific and technical personnel, techniques, and research and development progress.

d. Chief of Engineers. The Chief of Engineers is responsible for making maps and geodetic surveys that show the location, identity, and physical characteristics of all natural, cultural, and military surface features of foreign geographical regions. His duties also include the development of intelligence data on the physical engineering characteristics and the conditions required for the maintenance, construction, reconstruction, and demolition of air, land, and water transportation systems. Responsibility for producing terrain intelligence has been assigned to the Chief of Engineers. For functions of the agencies that assist in the preparation of these studies see FM 5-30. Also under the staff supervision of G2, the staff engineer:

- (1) Produces and maintains terrain studies based upon terrain analysis. This involves:
 - (a) Determining the requirements for terrain information, based upon requests from G2.
 - (b) Collecting and evaluating terrain information.
 - (c) Assembling terrain intelligence into a terrain study.
- (2) Provides technical interpretation of the terrain covering such factors of military significance as obstacles, routes, and avenues of approach, cover and concealment, land forms, hydrology, cross-country movement and related subjects.
- (3) Disseminates terrain studies and other technically evaluated information through appropriate channels. For details of engineer responsibility in terrain intelligence see FM 30-10.

e. Chief Signal Officer. The Chief Signal Officer is responsible for the collection and processing of signal information and the production and maintenance of intelligence concerning telecommunications equipment and facilities used for control of traffic by

rail, air, motor transport, waterways, and within water terminals. From an intelligence point of view, communication systems which are installed and operated exclusively for railway operational use are generally considered a part of the railway system and are treated as such by Transportation Corps intelligence personnel. Detailed guidance for the collection of this information is given in DA Pam 30-100. The responsibilities of the Chief Signal Officer are described fully in FM 11-30.

f. Provost Marshal General. The Provost Marshal General is responsible for traffic control; traffic control reconnaissance, surveys, and studies; prisoner-of-war processing and evacuation; control of refugees and the circulation of individuals; and the protection of property and installations. Much valuable transportation information is accumulated during the performance of these functions.

g. Chief of Ordnance. The Chief of Ordnance is responsible for the production and maintenance of technical intelligence concerning ordnance materiel used in transportation. This applies particularly to motor transport equipment and supporting facilities and installations.

h. Chief of Civil Affairs. Civil affairs embraces the relationship between the military forces and civil authorities and the people in a free country or area, or in an occupied country or area when military forces are present. The Chief of Civil Affairs is responsible for the production and maintenance of intelligence about the area pertaining to its civil population, government, economy, and institutions. This includes transportation information that affects civil affairs plans and operations.

i. Transportation Officer. The transportation officer of any command is responsible for collecting transportation information, processing it into transportation intelligence, and disseminating it through appropriate channels. He uses transportation technical data and intelligence for his own military planning purposes and prepares special transportation intelligence studies, reports, and analyses for G2 use in estimating the effect of enemy transportation capacities and capabilities on both our own and enemy military operations. The transportation officer provides the transportation intelligence training required to qualify intelligence personnel under his control to perform their duties. To assist in establishing a continuing and thorough information collection effort, the transportation officer implements procedures to insure coordination and collaboration with other agencies on technical intelligence training, techniques, manuals, and other intelligence matters. He also

provides technical supervision and coordination of the intelligence activities of transportation staff sections, transportation intelligence teams, and transportation units of subordinate headquarters and assists these sections and units when possible. See FM 30-16 for further intelligence responsibilities of the transportation officer.

j. Transportation Intelligence Officer. This officer performs the intelligence staff function on the transportation officer's staff. He may be a team commander or some other member of the staff. He assists in the preparation of and executes the transportation officer's intelligence plans and elements of plans as prescribed by G2. The transportation intelligence officer trains his own section or unit in intelligence functions and in appropriate transportation subjects. Normally, he is delegated the responsibility for the technical supervision of teams and of transportation intelligence training and operations in staff sections and in units of subordinate headquarters. He coordinates with the operations officer in the preparation of training programs.

k. Transportation Staff Section Chiefs and Unit Commanders. Chiefs of transportation special staff sections and commanders of operating units keep the transportation intelligence officer and/or the appropriate transportation intelligence team informed of their current and anticipated operational plans and intelligence requirements. They are responsible for the prompt reporting and submitting of foreign transportation documents and captured transportation equipment which they gain possession of or of which they have knowledge. Information is forwarded to the next higher echelon without delay. Captured enemy documents and materiel are reported promptly and processed through appropriate channels. Each Transportation Corps unit commander and staff section chief insures that all personnel under his command know and understand their intelligence duties.

l. Other Transportation Corps Personnel. All personnel are responsible for reporting promptly to their commander or section chief all information of intelligence value pertaining to the enemy, his strength, equipment, location, and movement. They too are responsible for safeguarding and turning in captured documents and equipment. Personnel in all headquarters and units must make a continuous effort to collect and to report all types of transportation information of potential intelligence value that can be collected within their area of operations.

CHAPTER 4

TRAINING

9. Introduction

a. General. Intelligence training generally follows procedures outlined in FM's 21-5 and 21-6 and applicable Army training programs. It is both specialized and general. Transportation intelligence specialists, assigned or attached to intelligence teams, are given specialized training in the collection and processing of information and in the production of intelligence. All transportation personnel, officer and enlisted, are given general training in transportation intelligence. In the general training, particular emphasis is placed on the collecting and reporting of pertinent information.

b. Responsibilities.

- (1) The Chief of Transportation is responsible for insuring that facilities and appropriate programs of instruction are provided for general and specialized transportation intelligence training of Transportation Corps personnel and units. FM 30-16 states responsibilities and general subjects to be covered in the programs of instruction.
- (2) Commanders at all echelons are primarily responsible for transportation intelligence training of the personnel in their commands.
- (3) Transportation intelligence officers, through close coordination with plans and training officers, are responsible for establishing the transportation intelligence training program and for staff supervision of this program. This program must include the training of intelligence specialists as well as other personnel. Integrated and concurrent training should be incorporated in the program whenever possible (par. 12).
- (4) Unit officer and noncommissioned officer personnel are also responsible for transportation intelligence training, particularly the training of personnel who are not intelligence specialists. Unit training offers the chief opportunity for integrated and concurrent training.

c. Training.

- (1) Officer and enlisted transportation intelligence specialists are trained to research, collect, process, and report transportation technical information and intelligence. Their primary mission is to convert information into useful intelligence. They receive special training in the various modes of transportation and are normally assigned to transportation intelligence teams. The appendixes of this manual and ATP 55-207 should be used for guidance in the preparation of training programs for these specialists. Whenever possible, potential team members should receive their specialized training at service schools.
- (2) All other personnel must be trained to be aware of the importance of intelligence and to understand the fundamentals of collecting and reporting information. Intelligence training should be taught whenever possible as concurrent and integrated training (par. 12).

10. Objectives

a. Creating Intelligence Consciousness. The development of intelligence awareness in both individuals and units should be the principal objective of a training program. Sources of information, the ability to recognize information of intelligence value, methods of collecting, and methods of reporting are of primary importance. All personnel must be trained to observe carefully, to remember what they have observed, and to report observations promptly. Emphasis must be placed upon the objective reporting of facts—not the interpretation of facts by personnel not qualified to do so.

b. Establishing a Situation. Because one objective of intelligence training is proficiency in combat, as much training as possible should be conducted in a tactical situation and with a simulated or actually played enemy. Individual and unit training should be conducted in realistic situations.

c. Emphasizing Subjects Related to Transportation. Although almost any observation may become a part of the broad field of intelligence, emphasis must be placed upon subjects related to the various modes of transportation.

11. Pertinent Subjects

The subjects listed or referred to below cover items that pertain, either directly or indirectly, to transportation intelligence. Train-

ing officers may use these lists as guides when making training plans and schedules. The subjects listed in *a* below should be taught to all transportation personnel; transportation intelligence specialists and those who are concerned with the transport mode indicated should be instructed in the subjects listed in *b* below. FM 30-16 lists additional subject matter.

a. Subjects Common to all Transportation Modes.

- (1) Purpose and scope of intelligence.
- (2) The intelligence cycle.
- (3) Methods of collecting and reporting information; theory and practice of observation.
- (4) Counterintelligence and security.
- (5) Information sources in general: captured military and civilian personnel, photographs, documents, captured materiel, facilities, and installations.
- (6) Organization and mission of transportation intelligence teams.
- (7) Policies concerning war trophies.
- (8) Guerrilla warfare and its effect on transportation.
- (9) Map and photograph evaluation; terrain analysis.
- (10) Counterintelligence applied to transportation.
- (11) Responsibility of individuals for technical intelligence.
- (12) Determination of enemy transport capabilities and vulnerabilities.
- (13) Security discipline; use of signs and countersigns.
- (14) Identification of enemy equipment, clothing, and insignia.
- (15) Maintenance of operations maps; military symbols.
- (16) Defense against enemy propaganda.
- (17) Training in the use of enemy weapons and equipment.
- (18) Organization and characteristics of enemy armed forces.
- (19) Handling and processing of captured enemy personnel and documents.
- (20) Route reconnaissance and classification.
- (21) Intelligence responsibilities of the Transportation Corps; objectives of transportation intelligence.
- (22) Effect of climate, weather, and terrain on transportation.
- (23) Captured enemy materiel: examination, marking, evacuation.
- (24) Determination of when to classify intelligence data; importance of keeping from the enemy what we know about him.

- (25) Importance of transportation intelligence to tactical and strategic planning.
- (26) Languages of the areas of operations.
- (27) Determining effects of CBR and nuclear warfare on transportation. (See FM 3-130 for detailed information.)
- (28) Related subjects.
 - (a) Communications.
 - (b) Code of conduct, evasion, escape.
 - (c) Elementary map and aerial photograph reading.
 - (d) Organization of the U.S. Army and its relationship to other services.
 - (e) Camouflage discipline.
 - (f) Basic photography.

b. Subjects Peculiar to Transportation Modes.

- (1) Aviation Information Requirements (app. II); Aviation Terms (app. X).
- (2) Inland Waterway Information Requirements (app. III); Inland Waterway Terms (app. X).
- (3) Motor Transport Information Requirements (app. IV); Motor Transport Terms (app. X).
- (4) Port, Beach, and Landing Area Information Requirements (app. V); Port, Beach and Landing Area Terms (app. X).
- (5) Railway Information Requirements (app. VI); Railway Terms (app. X).
- (6) Miscellaneous Transportation Information Requirements (app. VII).

12. Types of Training

The three general types of training—scheduled, concurrent, and integrated—are described below. It is of the utmost importance that all training time be used efficiently; this requires detailed planning and careful supervision to insure that each man is fully occupied during all of his allotted training time. See FM's 21-5 and 21-6 for detailed techniques of military instruction.

a. Scheduled Training. This is training that is programed in accordance with ATP's, postcycle POI's, and other appropriate authorities. Scheduled training usually consists of basic, cadre, advanced individual (MOS), unit, postcycle, and school training.

b. Concurrent Training. Concurrent training is used when all troops cannot be taught a scheduled subject at the same time. Those that are awaiting instruction in a particular scheduled subject should receive training in some other scheduled subject. Examples of concurrent training are—

- (1) During range firing, personnel who are not on the firing or ready line may be trained in reporting information about the enemy.
- (2) Personnel who are awaiting their turn in practical driving instruction may be instructed in the theory and practice of observation.

c. Integrated Training. Training that is conducted in addition to and as part of a regularly scheduled subject and that affects the entire unit at the same time is integrated training. Subjects to be integrated should be related to, but not necessary to, the effective presentation of the scheduled subject. One or more subjects may be integrated with the scheduled training. The personnel concerned should have received previous instruction in the integrated subjects. Examples of integrated training are—

- (1) Collection of roadway data during a motor march.
- (2) Collection of beach and landing area data during an amphibious exercise.

CHAPTER 5

OPERATIONS

Section I. COORDINATION AND LIAISON

13. General

Transportation intelligence activities at each level of command will be coordinated with G2 and other appropriate agencies, through the transportation intelligence officer, in accordance with doctrine and procedures prescribed in FM 30-16.

14. Coordination

Transportation intelligence should be available to all levels of command if intelligence coordination is maintained between all echelons. Maintenance of a close, systematic, and continuous coordination by the individuals and activities listed below will help to establish the essential elements of information, eliminate duplication of effort, expedite collection and processing, and insure adequate dissemination of intelligence data.

a. Transportation intelligence officer, plans officer, and other elements of the transportation section.

b. Intelligence elements of transportation staff sections.

c. Communications zone transportation sections and their counterparts in army and adjacent commands.

d. Other staff sections—particularly the engineer sections because of similar intelligence interests.

e. Military intelligence units at division, corps, and field army levels from which intelligence support (imagery interpreters, order of battle specialists, counterintelligence agents, interrogators of prisoners of war) may be obtained.

f. Intelligence elements of the Navy, Air Force, and allied forces through the Assistant Chief of Staff for intelligence (FM 30-16).

Section II. DIRECTION OF COLLECTION REPORT

15. General

Direction of the collection effort involves these important pro-

cedures: determination of information requirements and establishment of priority of items of information required, check of information available from other offices and agencies, allocation of available collection effort after balancing requirements against capabilities, issuance of requests for and orders to collect required information, evaluation of collection reports, and issuance of new instructions to collecting agencies. Guidance must be provided collecting agencies on the specific transportation information needed, time limitations when applicable, priorities of requirements, and means by which agencies can improve their transportation information collection effort. Collection agencies should be advised of changed priorities and completion of specific requirements. Direction and supervision of these activities is the responsibility of the G2 at each level of command.

16. Determination of Requirements

a. Essential Elements of Information. The unobtained items of needed information or intelligence required by a commander at a particular time to enable him to make a decision with confidence are the essential elements of information (EEI). In the collection of transportation information, the primary concern is the effect of the enemy, weather, and terrain at a given time upon the transportation mission (par. 20g). The EEI depends entirely upon the situation; designation of the EEI is the responsibility of the commander. He should state the EEI, specifying items with the highest priority in sufficient time for the collection agencies to perform their mission properly. At each echelon, the essential elements may include certain requirements of higher, lower, and adjacent echelons. Although the primary mission of the collection agencies is the satisfying of the EEI, they must also collect and report any additional information acquired.

b. General Requirements. All transportation personnel should collect and report all types of information of intelligence value within their areas of operations (par. 8l). Appendixes II through VII provide a guide for information requirements pertaining to aviation, inland waterways, motor transport, ports, beaches and landing areas, railways, and miscellaneous modes of transport.

c. Specific Requirements. Specific guidance in the collection of transportation information and the production of intelligence is furnished by the following media and agencies:

- (1) The transportation sections of the National Intelligence Surveys contain the available data on major transportation facilities and principal routes in foreign areas. Transportation information gaps and deficiencies are

indicated. This publication is available at oversea theater and command headquarters to meet initial wartime and peacetime military transportation planning and operational needs. Transportation officers and unit commanders endeavor to supplement this initial intelligence.

- (2) Analysis of transportation plans, annexes, and special transportation capability studies prepared by transportation personnel at various levels of command furnish guidance for determining information requirements. During the preparation of these plans and studies, a listing of intelligence gaps and deficiencies is developed for submission to the transportation intelligence officer who initiates appropriate collection effort.
- (3) Requirements specified by G2, transportation staff planners, transportation units, and others.

d. Implementation and Guidance. The transportation intelligence officer at each level of command assembles and determines priority of transportation information requirements of his own and other headquarters, analyzes them, and incorporates them into his collection plan (par. 18). He checks all sources of information and makes requests to appropriate collecting agencies. He evaluates reports, issues instructions, and furnishes continuous guidance to collecting agencies through appropriate channels.

Section III. COLLECTING AND REPORTING INFORMATION

17. General

a. Transportation information embraces all pertinent information about the various modes of transportation. Collection includes coverage of foreign areas that are under the control of our own, friendly, and hostile military forces and that are of immediate or potential significance to planning. Complete, comprehensive coverage is desired. Collection continues in peacetime as well as in periods of hostility. Every effort must be made to collect, report, and compile all basic transportation information needed for present and future military planning. The collection scope includes manmade and natural features of an area of operations. Emphasis must be placed upon the factors that greatly affect the different modes of transportation. For example, in a heavily populated area, manmade factors may be important, whereas natural features may be of greater importance in arctic, desert, and jungle areas. The impact of nuclear and CBR warfare may be an im-

portant consideration. The type of coverage needed must be determined before preparing a collection plan.

b. The office of the Chief of Transportation needs the following information about the armed forces of foreign nations.

- (1) Top transportation echelons of the government, such as ministry of transport, bureau of rivers and docks, army headquarters, and other elements of defense having transportation responsibilities. Information should include—
 - (a) Organization, strength and grades, and responsibilities.
 - (b) Type of control and how accomplished.
 - (c) Extent of coordination with other governmental agencies.
 - (d) Chain of command through subordinate echelons.
- (2) Organization, mission, functions, responsibilities, personnel and equipment strengths, and capabilities of transportation headquarters, units, and detachments at all levels.
- (3) Training methods and programs, schools and other training installations, tactical doctrines, and methods of procurement.
- (4) Order of battle information of transportation forces.
- (5) Mobilization system and potential of civilian and quasi-military agencies, facilities, equipment, and personnel.
- (6) Overall appraisal of transportation forces as components of the fighting machine, including strengths, weaknesses, past performances, and expected future developments.
- (7) System of maintenance, including methods of implementation, repair, evacuation, and replacement of equipment and efficiency of system and personnel.

18. Collection Plan

a. Formulation of the collection plan depends upon the situation and the time element involved. The plan must coincide with the commander's needs at a given time for a given period. The intelligence officer must always be guided by what his commander needs to know, when he needs to know it, and what collection agencies can best provide the information. After the information requirements have been determined (pars. 16 and 17), the transportation intelligence officer prepares a collection worksheet. The worksheet specifies the information needed to fulfill requirements, and is

designed to insure the systematic exploitation of all sources, by all means, and within a specified time. The worksheet may be prepared in any appropriate format. It should show unit, situation, period covered, transportation mission, area involved, EEI (elaborated upon if necessary), specified collecting agency or agencies, and instructions for reporting the information. The collection plan is developed from this worksheet. The plan does not have to be written, and if written, can be very brief—consisting of only a few notes.

b. The EEI should be as concise as possible. Obvious items should not be explained; items that are not obvious should be explained in sufficient detail for the collecting agency to clearly understand its mission.

19. Collection Agencies

Any individual or organization which collects or processes information, or both collects and processes information is a collection agency (FM 30-5). The intelligence branch of the transportation special staff section, the transportation intelligence teams, and other transportation units constitute the transportation collection agencies. Transportation units or personnel may be assigned special collection or reporting tasks. Transportation information is collected by the agencies listed in FM's 30-5 and 30-16, including the G2 sections of all commands, the intelligence elements of various technical services (particularly the Corps of Engineers), Naval Intelligence, Air Force Intelligence, and other agencies. All transportation personnel are potential collectors of transportation information. Selection of the collection agency depends upon its location, training, and qualifications for the mission.

20. Sources of Information

A source is a person, thing, action, or condition from which desired information is obtained. In general sources listed in this paragraph are those used by the transportation officer and his assistants and include agencies or persons which may also be collecting agencies. Foreign sources are given in appendixes II through VI by transportation modes. See FM's 30-5 and 30-16 for further discussion of information sources. Principal general sources are—

a. *Persons.*

(1) Military and civilian personnel of the Transportation

Corps and other technical services, the Army, Navy, Air Force, Marines, and Coast Guard.

- (2) Military police personnel.
- (3) Civil affairs personnel.
- (4) Civil authorities and local civilians.
- (5) Representatives of contracting and engineering firms, export-import firms, manufacturers, suppliers, airlines and steamship lines, public utilities, and other agencies concerned with transportation.
- (6) Captured enemy personnel, deserters, defectors, repatriates, and refugees. For detailed procedures in handling and interrogating prisoners of war, see FM's 19-40 and 30-15.
- (7) G2 personnel.
- (8) Employees of—
 - (a) Major oil companies.
 - (b) Tourist, statistical, and census bureaus.
- (9) Civilian and governmental transportation officials.

b. Documents. This source consists of written, printed, engraved, and photographic material—such as: maps, sketches, orders, tactical and technical manuals, cryptographic material, insignia, letters, photographs, diaries, notebooks, logbooks, maintenance records, newspapers, service records, and commercial transportation magazines and periodicals. Bookstores, libraries, captured enemy headquarters, command posts, observation posts, personnel, and all types of cargo and personnel-carrying vehicles are possible sources of documents. At least one copy, preferably two, of all basic documents, maps, and diagrams should be forwarded through intelligence channels to the appropriate transportation officer. Examples of documents of a general nature are—

- (1) Charts, manuals, manning tables, tables of organization and equipment, and related publications that show organization, functions, and staffing of departments, agencies, and operating units.
- (2) Training aids, field and technical manuals, courses of instruction, lesson plans, textbooks, and other military training material.
- (3) Transportation research and development plans and progress reports, including reports on characteristics and capabilities of new equipment and facilities and current developmental trends.

- (4) Technical and scientific publications, including reports, studies, and analyses dealing with transportation developments, operations, and problems.
- (5) Terrain, geographic, economic, commercial, industrial, military, and similar studies that give details on transportation systems, routes, facilities, structures, and equipment.
- (6) Handbooks and similar publications. For example: transportation equipment manufacturers' handbooks, maintenance and servicing manuals, equipment catalogs, parts and accessories lists, operating instructions, design specifications, construction standards, working drawings, blueprints, photographs, films, test reports, scale models, prototypes, production records and schedules, sales records, advertising brochures, engineering textbooks, and other material dealing with design and construction standards, equipment specifications, or operating and maintenance practices.
- (7) Transportation activity plans, studies, reports—such as brochures of construction firms, transportation consultants, public utilities offices, defense agencies, public works departments, oil and mining companies, and similar agencies.
- (8) Tourist and travel agency literature on transportation routes and facilities, namely—maps, charts, photographs, operating schedules, timetables, and similar publications.
- (9) Governmental and commercial publications that contain transportation articles, operating statistics, engineering data, and photographs.
- (10) Technical dictionaries, encyclopedias, textbooks, and modern reference works on transportation subjects.
- (11) Manifests, track charts, station diagrams, route profiles, bridge and tunnel clearance diagrams, route logs, and equipment registers.
- (12) Cargo and shipping documentation for all transport modes.

c. Transportation Materiel. Transportation equipment includes motor vehicles, trailers, locomotives, rail cars, airplanes, helicopters, boats, and barges. The information obtained should include: model, type, date of issue, place of manufacture, condition, capabilities, and other characteristics that will assist in developing intelligence of tactical, technical, and strategic value.

d. *Transportation Facilities.* Information about air; inland waterway; motor transport; port, beach, and landing area; railway; and miscellaneous transportation facilities must be exploited (apps. II-VII). Transportation facilities that are overrun during combat should be examined without delay and detailed reports furnished through technical service and intelligence channels. Because of the collateral interests of the Transportation Corps and other agencies (par. 8), exploitation is more effective if made jointly.

e. *Related Facilities, Equipment, and Conditions.* Facilities, equipment, and conditions that affect transportation, such as communication systems, geography, hydrology, location of contaminated areas, and concealment constitute this source.

f. *Air and Ground Reconnaissance and Photography.* A chief source of information is the actual inspection of an area. Whenever possible, the information obtained should be clarified and supplemented by photographic coverage (par. 27c).

g. *Climate and Terrain.* Soil trafficability, visibility, operation and maintenance of equipment, cover and concealment, routes of communication, and mobility of vehicles and personnel are effected by climate and terrain. Extreme conditions caused by mountains, desert, precipitation, wind, heat, and cold are of particular significance. See FM 30-5 for a detailed discussion of the effect of climate and terrain.

21. Methods of Collection

General methods of collecting transportation information of intelligence value are research and observation, interrogation of a source, and liaison with the other technical services and combat units.

a. *Research and Observation.* Transportation Corps personnel must be alert constantly; they should observe and report everything of intelligence value. Personnel charged with information collection responsibilities make ground and air reconnaissance trips. Orders for these trips should specify the area to be reconnoitered, route(s) to be traveled, special features or structures to be observed, whether aerial photography is desired, and any other data desired and in what detail. Personnel must be trained to recognize and report on intercepted enemy communications, documents, maps, photographs, and materiel. Climatic data and the observation of enemy activity, or lack of it, may provide clues to vital information. Maximum use should be made of ground and aerial photography (par. 27c).

b. *Interrogation.* Enemy civilians and military personnel, including prisoners of war and deserters, are the chief sources of information gained from interrogation. The techniques of interrogation are explained in FM 30-15.

c. *Liaison with Other Military Units.* Transportation Corps personnel must take advantage of opportunities to obtain transportation information from combat units, other technical services, civil affairs units, military police units, and Naval and Air Force intelligence elements. Trained transportation intelligence personnel and/or technically qualified specialists should be made available to the units with which liaison is necessary. Personnel should be assigned sufficiently in advance to be thoroughly briefed. Liaison with military units is necessary for both tactical and strategic planning.

(1) *Tactical planning.* This is normally accomplished through liaison with the units concerned. Combat units are usually the first to discover information that can be used in transportation tactical planning. Continuous liaison with combat units, civil affairs units, military police units, the other technical services, particularly the combat engineers, and with supported or supporting Air Force and Navy elements is of prime importance. Accurate and current information will eliminate delays and duplication of effort, thus facilitating rapid formulation of transportation tactical plans.

(2) *Strategic planning.*

(a) Coordination with the same agencies shown in (1) above is also necessary for strategic planning and for research and development. The Corps of Engineers is the principal technical service with which the Transportation Corps is concerned. Responsibility for production and maintenance of lines of communication intelligence rests jointly with these two technical services.

(b) Transportation systems in the proposed area of operations must be evaluated. New construction of roads, bridges, railways, and water and air terminal facilities must be considered and planned. The impact on the land transportation system of Air Force and Navy requirements must also be considered well in advance. Finally, essential civilian use of lines of communication must be determined by intelligence activities before the actual outbreak of hostilities.

22. Collection in Arctic, Desert, and Jungle Areas

a. *Arctic.*

- (1) *Winter operations.* In arctic and subarctic areas the enemy's movement capability is of primary importance. Personnel and equipment must be moved over snow and ice by either air or surface transportation. Surface movement is usually over roads, frozen waterways, or cross-country. The local situation determines the transportation mode; sled dogs and motor transport are the usual modes. To determine the enemy's transport capability, information must be obtained about—
 - (a) Type, quality, and quantity of enemy equipment, including skis, snowshoes, special purpose vehicles (snow removal equipment, sleds, winter clothing, mobile shelters, and animals.
 - (b) The most suitable mode of transport for the area under consideration (pack or draft animals, air, rail, motor transport).
 - (c) Effect of weather and terrain conditions upon each possible mode of transport, including the load-bearing capacity of surfaces.
 - (d) Number of personnel available and the extent of their training in the operation and maintenance of transportation equipment.
 - (e) Status of supplies required for movement (POL, repair parts, etc.).
 - (f) Road and rail net available.
 - (g) Aviation facilities available, including aircraft by type, airfields and helicopter landing sites (approaches, exists, obstacles, topography, location, concealment, takeoff and landing directions, and condition of surface).
 - (h) Ability of the enemy to navigate in the Arctic.
 - (i) Ports and beaches available, degree of usability, ability of the enemy to discharge and receive cargo at each, and adequacy of connecting interior lines of communication.
 - (j) Ability of the enemy to stage air-transported operations.
 - (k) Movement capability of the enemy by each mode of transport, including foot marches.
 - (l) Rail equipment available and its condition.

(2) *Summer operations.* In addition to the information described in (1) above that applies also to summer operations, information will be needed about—

- (a) Bridging equipment, rafts, and boats available to the enemy.
- (b) Tides and swiftness of currents in streams and rivers.
- (c) Swamps, mud, dust, and rough, undeveloped roads; ability of the enemy to improve these conditions.
- (d) Location, description, and characteristics of inland waterway network.
- (e) Number and type of special purpose cross-country vehicles available to the enemy.

b. Desert. Securing information about the enemy's ability to move personnel and equipment under adverse conditions—rugged terrain, limited water supply, deep sand, windstorms, salt marshes, and extreme temperature ranges—is a chief objective of collection agencies. Although temperature above 130° F is common in the desert in the daytime, such a drop may occur in the night that heavy clothing and warm bedding are necessary. Usually all the water needed for both men and machines has to be transported because sources are rare. Surface conditions and the lack of roads make special training in operating transport equipment mandatory. Information about the subjects listed below will help determine movement capability of the enemy.

- (1) Type, quantity, and quality of transport equipment, including an evaluation of the capability of equipment to traverse rugged terrain and sand without overheating.
- (2) Status of driver training, including ability to operate special traction equipment.
- (3) Status of critical supplies required for movement, such as POL, water, and repair parts.
- (4) Conduct of maintenance, including special provisions for avoiding excessive abrasive wear.
- (5) Ability to navigate in the desert.
- (6) Employment of aircraft.

c. Jungle. Human bearers, pack and draft animals, inland waterway craft, aircraft, and motor vehicles are the transportation media used in jungle operations. The particular nature of the area determines the medium. The principal modes of jungle transport are usually human bearers and pack animals. Inland waterways are used to the maximum extent possible, because this mode is economical and practical. Aircraft can be employed frequently.

Parachute and free-fall supply techniques can be used when landing is not possible. The use of motor transport in jungles is limited—being used only where there are roads or where vegetation is not heavy. Small wheeled-vehicles and trailers, and small tracked-vehicles can be used on trails; however, this usually requires the use of pioneer troops. Transportation information for jungle operations should include—

- (1) Availability and dependability of human bearers and of pack and draft animals.
- (2) Availability and characteristics of inland waterways.
- (3) Type, quantity, and quality of aircraft and inland waterway craft.
- (4) Motor transport availability and suitability for employment.
- (5) Nature of the terrain, including amount and quality of vegetation.
- (6) Enemy transportation personnel, including pioneer troops.
- (7) Effect of deterioration upon supplies, such as rations, forage for animals, POL, and repair parts. (It should be borne in mind that jungle vegetation is normally not suitable food for domesticated animals. Food for such animals must be carried.)
- (8) General transportation capability analyses for both dry and wet seasons.
- (9) Ability of the enemy to navigate in jungles.

23. Estimating the Effect of Nuclear and CBR Operations on Transportation Capability

Although the collection of nuclear and CBR information is primarily a function of the chemical officer at each level of command, the transportation officer, through liaison with the chemical officer, must assess the presumptive impact of nuclear and CBR operations on transport capability. Before a nuclear or CBR attack, data must be evaluated to estimate the probable effect on transport capability. After an attack, the damage to personnel, facilities, and equipment must be determined. Generalizations about these operations and assessing the resulting damage are discussed below.

a. Nuclear and CBR Operations.

- (1) *Nuclear warfare.* Nuclear warfare may cause mass destruction and radioactive contamination. Nuclear weapons can be employed against personnel, equipment, supplies,

and facilities and are especially effective when used against advanced civilizations. The scale of nuclear warfare determines the type and degree of protection required for adequate security of units and installations. Knowledge of enemy nuclear capabilities permits the commander to judge the degree of vulnerability a command can accept in accomplishing a mission. This knowledge can be the deciding factor in selecting a course of action and in locating units and facilities.

- (a) Limited use of nuclear weapons dictates that forces adopt measures which permit speed, dispersion, and a high degree of air and ground mobility. Information concerning routes available to the enemy assists in determining enemy capabilities and vulnerabilities and courses of action for our own forces.
 - (b) Unlimited nuclear warfare further increases the importance of ground and air mobility. It increases reliance upon flexible modes of transport, such as motor and air, while decreasing the use of fixed facilities, such as major ports, main rail lines, and large transportation centers. It also increases the importance of counterintelligence, reconnaissance, surveillance, target acquisition, dispersion, and communications. A command must be dispersed so as not to expose disproportionate parts to destruction.
 - (c) Employment of nuclear weapons on any scale requires that maximum advantage be taken of terrain configuration if the transportation mission makes this possible. The effects of heat and blast in particular are greatly minimized when deflected by irregularities in the terrain. For example, routes of communication located in gorges, steep valleys, or in mountainous areas present less favorable nuclear targets than routes located on flat terrain if the axis of the valley or ravine points well away from ground zero. If the axis of the valley points toward ground zero, there is little or no shielding effect and blast damage may be increased because of channelizing the blast wave. Furthermore, such routes as these may be blocked by obstacles and induced radiation patterns that cannot be circumvented.
- (2) *Toxic agents and living organisms.* Chemical and biological agents can completely destroy transport capability by rendering ineffective the required number of personnel

and animals. They can be used either directly or indirectly against personnel. They can be used indirectly by contaminating corps, water supplies, and equipment. These agents may be employed for either tactical or strategic reasons. Particularly in backward areas of the world where decontamination procedures, sanitation facilities, and medical supplies are lacking, chemical and biological weapons could be decisive by destroying vast segments of the population.

- (3) *Dispersion.* Because of the potential of nuclear and CBR weapons, large concentrations of enemy personnel offer the most profitable targets. Consequently the enemy will probably disperse both personnel and equipment to the maximum extent possible. Dispersal capability has been greatly increased by improved communications. For example, miniaturization of equipment and use of automatic data processing systems make it possible to disperse depots, supply points, and collecting areas. It must be assumed that the enemy has made progress similar to ours in these fields and will disperse his personnel, equipment, and supplies over a wide area.
- (4) *Flexible supply system.* Dispersion of personnel and equipment necessitates the use of a flexible supply system. The enemy may be expected to employ a system of mobile replenishment: large quantities of materiel will not be stockpiled. Underground shelters will probably be used to avoid nuclear and CBR hazards.

b. *Assessing Damage.* General, tactical, and strategic assessment of damage is necessary after a nuclear or CBR attack.

- (1) *General.* After an attack, it is of paramount importance to determine the enemy's ability to recover. The degree to which his transportation system has been destroyed—including personnel, equipment, and facilities—must be assessed without delay. It is of equal importance to estimate his ability to replace personnel and equipment, to employ reserve supplies, to repair or rebuild facilities, and to make use of such recovery methods as rescheduling, rerouting, and decontamination. In addition to assessing the enemy's ability to recover, the possibility of our own forces using the area must also be determined. Information is needed about the time involved before our own forces can enter the area because of residual radiation or other contamination; the extent

of destruction of transportation facilities for all modes of transportation and the repairs required; the radioactive, chemical, or biological contamination of transportation facilities in the area; and the decontamination and individual protective measures required.

- (2) *Tactical.* When assessing tactical damage, it is almost always desirable to base the analysis on casualties rather than on damage to materiel, with the exception of bridges and key structures. If transportation has been immobilized because of casualties that are not readily replaceable, sufficient effect has been obtained. Casualties from chemical and biological weapons will depend primarily upon the availability and use by the enemy of protective masks, cover, medical supplies, and immunizations. Important considerations in the assessment of casualties from nuclear and CBR weapons are—

(a) *Temperature.*

1. Nuclear attacks delivered during extremely low temperatures normally result in fewer casualties because of the tendency of personnel to seek shelter from the weather.
2. Low temperature reduces flash burns and the effects of thermal radiation because of the heavy clothing worn.

(b) *Haze, mist, and fog.* These atmospheric conditions reduce the thermal radiation and flash effects of nuclear explosions, but tend to increase radioactive contamination.

(c) *Rainfall.* Rainfall reduces the effects of thermal radiation by raising the ignition point of personnel and objects. It can also wash a certain amount of chemical, biological, and radioactive contamination from personnel, equipment, and facilities, but in turn produces greater contamination of drainage systems and low areas.

(d) *Wind.* Wind direction and velocity do not greatly affect blast, thermal radiation, and initial nuclear radiation; they do affect residual radiation caused by fallout and the distribution of chemical and biological agents.

(e) *Terrain.*

1. Ravines, deep valleys, and mountainous terrain in

general greatly reduce personnel casualties from blast, flash burns, and initial nuclear radiation.

2. Forests or heavily wooded areas minimize the effects of thermal radiation; however, the resulting hazard of forest fires and falling limbs and trees is great. Fallen trees and the induced radiation pattern may increase the number of casualties and restrict use of the area.

(f) *Built-up areas.*

1. Built-up areas shield personnel from heat, radiation, and moderate blast; severe blast increases the hazard in these areas because of falling debris.
2. Personnel protected by well-prepared and deeply dug fortifications experience relatively few casualties from nuclear bursts.

(g) *Enemy training status.* The number of casualties is affected by the enemy's nuclear and CBR training, particularly his detection and identification capabilities.

- (3) *Strategic.* Damage assessment in the strategic sense is based primarily on the enemy's war-making potential. This includes evaluation of damage to structures, factories, transportation systems, crops, and natural resources. Strategic damage assessment is made by theater special damage assessment teams; these teams obtain technical information and increase our knowledge of nuclear and CBR weapons effects.

c. Commander's Evaluation. After considering the factors discussed in *a* and *b* above, the commander must evaluate transportation capability before and after a nuclear or CBR attack. Evaluation must be continuous and must keep pace with changing situations; it must include estimating both enemy and friendly force capability in the specified area.

24. Determining Enemy Capability to Transport Missiles and Nuclear Weapons

The enemy's missile and nuclear weapon transport capability is a primary concern of the transportation planner. The sizes and weights of missiles and their component systems, the special problems involved in transporting fuel and oxidizers, and the characteristics of the enemy's transportation modes must be considered when collecting information. The topics listed below may be used as a collection guide.

a. General.

- (1) Transport responsibilities of individuals, units, staffs, and agencies.
- (2) Safety regulations in effect or lacking.
- (3) Methods of transporting classified shipments.
- (4) Labels, seals, and placards in use.
- (5) Missile description (operational and in research and development).
 - (a) Nomenclature, model, and type.
 - (b) Classification.
 1. Use and range (surface-to-surface, surface-to-air, etc.).
 2. Purpose and employment.
 3. Propulsion and guidance systems: rocket engine, booster engine, guidance system.
 - (c) Characteristics.
 1. Missile components (explosive, nonexplosive) and containers.
 2. Propellants (liquid and solid) and containers.
- (6) Tactical organization.
 - (a) Command and organizational structure.
 - (b) Deployment.
 1. Mobile.
 2. Fixed: missile launching sites, assembly or recycling areas, storage areas, depots, or area defense complexes.
 - (c) Movement. This refers to the normal modes of transportation and includes types of equipment used in administrative and tactical movements for initial deployment and resupplying of missiles and supporting equipment.

b. Sizes and Weights of Transportable Items. The sizes and weights of the items listed below should be obtained. Whenever possible, diagrams of shipping containers should also be procured.

- (1) Delivery vehicle (shell, motor) and integral propellants.
- (2) Warhead and adaptation kits.
- (3) Propellant containers if not an integral part of the delivery vehicle.
- (4) Ground support equipment.
 - (a) Transporting, erecting, and launching.
 - (b) Ground guidance and antenna.
 - (c) Testing and maintenance.

- (d) Propellant manufacturing and storage.
- (e) Auxiliary: compressor and power generating, assembling and fueling.

c. Enemy Capability of Handling Shipping Problems. The enemy's capability to transport oxidizers, such as hydrogen peroxide and liquid oxygen; radioactive materials; conventional explosives; radioactive materials with conventional explosives; deadly unstable material, such as plutonium; solid and liquid fuels; and all flammable liquids that present shipping problems must be assessed. Special consideration must be given to—

- (1) *Movements limitations.*
 - (a) Dimensions and configuration.
 - (b) Weight and center of gravity.
 - (c) Other limitations, such as stability, speed, gradeability, braking, turning radius of vehicles, including tractor-semitrailer combinations.
- (2) *Sensitivity.*
 - (a) Shock and vibration.
 - (b) Temperature and humidity.
 - (c) Evaporation.
- (3) *Hazards and countermeasures.*
 - (a) Detonation or explosion.
 - (b) Flammability.
 - (c) Corrosion.
 - (d) Acid burns and toxic poisons.
 - (e) Chemical, biological, and radiological.
 - (f) Protective clothing and equipment.
- (4) *Handling and intransit storage.*
 - (a) Proximity limitations that control quantity and distance.
 - (b) Surveillance restrictions and inspections.
 - (c) Decontamination and disposal.
 - (d) Security.

d. Methods of Shipment. The number or quantity of the item to be shipped and the type, characteristics, cargo dimensions, and number of carriers involved must be determined. Missiles and nuclear weapons are usually transported by—

- (1) *Rail.*
 - (a) Conventional rolling equipment, such as boxcars, flatcars, and tank cars.
 - (b) Special purpose rail equipment.

- (2) *Motor transport.* Commercial and military motor vehicles—conventional and special purpose.
- (3) *Water carriers.* Commercial and military.
- (4) *Aircraft.* Commercial and military.

25. Determining Enemy Transportation Order of Battle

Order of battle is the manner in which transportation forces are organized, disposed, maneuvered, and supplied. Intelligence concerning these forces consists of processed information about their composition, disposition, strength, training, tactics, logistics, and efficiency. Particular areas of interest in the collection of order of battle information are outlined below. See FM 30-19 for detailed discussion of order of battle intelligence.

a. General Information on Ground Forces and Army Air Transportation.

- (1) Strengths, weaknesses, and trends (short and long range).
- (2) Significant foreign influences.
 - (a) Advisory groups.
 - (b) Sources of military aid.

b. Administrative Organization.

- (1) Army high command.
 - (a) Departmental or ministerial organization.
 - (b) Overall transportation organizations.
 - (c) Chain of command—through territorial headquarters and field forces.
 - (d) Organizational charts of high command transportation and transportation support sections.
 - (e) Proposed changes in the event of war.
- (2) Functions, including internal organization of each transportation bureau and staff division.
- (3) Arms and services, including status, concept, and functions of transportation service.

c. Tactical Organization and Location of Transportation Service Units.

- (1) Tables of organization for all modes.
- (2) Implementation of tables of organization—personnel and equipment.
- (3) Mission, capability, and normal assignment.
- (4) Location.

d. Strategy and Defenses.

- (1) Permanent fortifications within transportation installations.
- (2) Fortifications for any transportation facility with a potential military use.

e. Training and Tactics.

- (1) Quality and effectiveness of transportation training system.
- (2) Strengths, weaknesses, and current trends.
- (3) Influence of foreign military missions.
- (4) Tactical doctrine for transportation operations.
- (5) Types of units, training, and equipment for special transportation operations.
- (6) Individual training.
 - (a) Basic, advanced, and specialized training courses for officer and enlisted transportation personnel.
 - (b) Organization and function of transportation training installations.
 - (c) Replacement training system in wartime.
 - (d) Transportation training in schools of allied countries (student exchange program).
- (7) Unit training.
 - (a) Systems employed and effectiveness.
 - (b) Number and type of units involved.

f. Logistics.

- (1) Classification of transportation equipment and supplies.
- (2) Procurement.
 - (a) Planning and control.
 - (b) Design, placement of orders, acceptance, and testing.
 - (c) Role of other governmental agencies.
 - (d) Amount produced domestically by private industry and government arsenals, and amount imported.
- (3) Peacetime storage and issue.
 - (a) System of storage and issue in zone of interior.
 - (b) Installations, depots, and other storage installations.
- (4) Wartime supply and movement.
 - (a) Requisition and supply in time of war.
 - (b) Efficiency of system.
 - (c) All transportation organization responsibilities and functions in army-unit movement and resupply requirements.

- (d) Military use of civilian transport.
- (5) Echelons of maintenance and repair.
- (6) Evacuation.
 - (a) Transportation equipment and personnel.
 - (b) Captured material and prisoners of war.
- (7) Transportation materiel.
 - (a) Quality and quantity.
 - (b) Existing condition and efficiency.
- g. Personalities.* Biographical data on key transportation personalities: name, rank, age, and present position.
- h. Quasi-Military Forces.*
 - (1) Transportation organizations receiving military training as preparation for wartime military service.
 - (2) Transportation organizations within military forces used for security or border guard work.

26. Evaluating Political, Economic, and Scientific Aspects of Enemy Transportation System

a. The political situation vitally affects national unity and defense and must be considered when evaluating the enemy's overall transport capability. Decisions that immediately affect national defense can be made in countries that have centralized governments. The transportation intelligence officer should be informed about—

- (1) Legislation.
 - (a) Current transportation codes.
 - (b) Budgetary provisions for transportation.
 - (c) Trends favoring one or more modes of transportation.
 - (d) Neglect of one or more modes of transportation.
- (2) Attitude of national government on transport matters.
 - (a) Governmental control measures.
 - (b) Plans for improving transportation.
 - (c) Attitudes of political leaders toward transportation.
- (3) Public interest in improved transportation.
- (4) Political personalities favoring rapid expansion of transportation.

b. The status of transportation in the economy of a nation can be judged by the effectiveness of transportation systems, their history and development, plans for future development, importance of the various modes, and national needs. Economic information can be obtained by studying—

- (1) Industrial supply for all modes of transportation.
 - (a) Sources of supply of aircraft, land vehicles, marine craft, equipment, supplies, raw materials.
 1. Domestic production (adequacy and capacities).
 2. Foreign sources of supply (agreements in force).
 3. Government controls and operating agreements with industry.
 4. Contracts, agreements, and labor relations within industry.
 - (b) Research and development (production techniques, industrial expansion, modification of product, efficiency).
 - (c) Brochures.
- (2) Statistical transportation information.
 - (a) Transportation factors influencing production.
 - (b) Extent of government subsidization of privately owned common carriers.
 - (c) General reports of transportation associations and companies.
 - (d) Self-sufficiency of government-owned transportation.
 - (e) International organizations' reports reflecting conditions in the area.
 1. United Nations Transportation and Communications Commission.
 2. North Atlantic Treaty Organization.
 - (a) Planning Board for Ocean Shipping.
 - (b) Planning Board for European Inland Surface Transport.
 - (c) Planning Committee for International Civil Aviation Organization.
 3. International Civil Aviation Organization.
 4. Pan-American Railway Congress.
 5. Pan-American Highway Congress.
 6. United Nations Regional Commission.
 - (a) Economic Commission for Europe.
 - (b) Economic Commission for Latin America.
 - (c) Economic Commission for Asia and the Far East.
 7. Southeast Asia Treaty Organization.
 8. American-British-Canadian Agreements.
 9. Organization of American States.

c. Information essential to the development of transport knowledge touches upon the entire scope of scientific and technical

analysis, including both materiel and methods. This information can be obtained by studying—

- (1) Aviation (army aircraft, airfields, and heliports).
- (2) Capabilities and capacities of equipment and transport facilities.
- (3) Chemical, mechanical, and nuclear applications.
- (4) Centers of gravity of equipment.
- (5) Combat development (materiel and methods).
- (6) Cost and efficiency studies.
- (7) Engine and power train research and development.
- (8) Energy (thermoelectric, thermochemical, and nuclear) conversion and storage.
- (9) Hydraulics of liquids.
- (10) Hydrology.
- (11) Marine transport, including lighterage, amphibians and over-the-beach operations.
- (12) Material handling devices.
- (13) Missile transport by modes.
- (14) Motor transport development, including overland trains.
- (15) Physical forces: their use and applications.
- (16) Pressure-volume-temperature ratios and applications of gases.
- (17) Processing systems for data and their effects on dispersion of forces.
- (18) Properties of materials (solid, liquid, gaseous) at different temperatures.
- (19) Propulsion devices for water, air, and vacuum.
- (20) Rail transportation facilities.
- (21) Roll-on, roll-off cargo operations.
- (22) Shock and vibration effects.
- (23) Subsurface marine carriers and underwater storage.
- (24) Surface skimming craft and vehicles.
- (25) Terminal layouts and facilities.
- (26) Transportation communications.
- (27) Transportation equipment research and development materiel, designs, and specifications.
- (28) Vulnerability studies, including heat, blast, radiation, biological, and chemical effects.

27. Reporting

a. *General.* Reporting information is as important as collecting it. Data is of little or no value unless it is transmitted through proper channels so that appropriate action can be taken. Reports must be accurate, clear, concise, complete, and timely. Whenever practicable, they should include operational experience data. Applicable documents (par. 20b) should be appended to each report if possible; if applicable documents are not appended, reference should be made in the report to their location and availability. In addition to a written or an oral report, maps and photographs should be submitted when appropriate. If the time limit precludes the submission of a written report, an oral report may be submitted. A report may also be submitted piecemeal as the information is received. Normally information is reported through specified staff and/or command channels (fig. 2). If it is necessary to act immediately on information obtained and at the level on which obtained, the report must include the action taken. The person submitting a report must be guided always by *what the commander needs to know and when he needs to know it.*

b. *Maps.* Maps may be attached to reports to show terrain conditions, communication routes, and trafficability. Adequate legends are of the utmost importance; all markings should be explained. Communication routes should be emphasized by depicting land routes in black and water routes in blue. Varying widths of black lines or dashes may be used to indicate different types of roads or pathways. Water routes should be marked heavily enough to distinguish them from streams. Trafficability may be indicated by a system of crosshatching in black; different types of soil or various kinds of vegetation may be shown by a crosshatching scheme in colors. The reporter may use any system of marking that is easily comprehensible.

c. *Photographs.*

- (1) Aerial and ground photographs may also be attached to reports to illustrate or supplement the information. A good photograph, when examined by experts, may give more and better information than many pages of narrative. Photographic coverage should be well planned. Whenever possible, all scenes and objects should be photographed from several angles. It is important that distances and dimensions in photographs be indicated by inclusion of people, vehicles, and other objects of known size. Photographs should be annotated and amply referenced. The date and exact time of day a photograph

field army, photographic units are located at division, corps, and army levels. In the continental United States, photographic service is furnished by Signal Corps photographic laboratories strategically located within each continental army area. Although photographic coverage is normally the responsibility of the Signal Corps, photographs obtained from any source are useful.

28. Evaluation by Collection Agency

The collection agency should put an evaluation rating (par. 30b) on all reports. This evaluation indicates to the next user (normally the processor) of the information, the credibility and reliability of the source and of the information itself. The source and date of information should be given whenever possible.

Section IV. PROCESSING INFORMATION AND PREPARING INTELLIGENCE FOR DISSEMINATION

29. General

The transportation officer produces and maintains the transportation intelligence required within his headquarters. He also prepares and maintains such additional transportation intelligence as may be directed by higher headquarters, including maintenance of files of special transportation studies and sections of the National Intelligence Surveys that concern transportation within his area of operations. Transportation intelligence is produced by processing transportation information: processing consists of recording, evaluating, and interpreting information collected.

30. Processing Procedure

a. Recording. Recording is the systematic selecting, sorting, grouping, cataloging, and filing of information. Recording must be systematic to insure minimum delay in evaluating the information obtained. Common aids used in recording are G2 journals, enemy situation maps, and G2 worksheets and intelligence files. See FM 30-5 for a detailed description of these aids.

b. Evaluating. Each processor evaluates items of information for pertinence, meaning, reliability of source, and probable accuracy. Methods of evaluation are discussed in FM 30-5. Evaluation is essential because in many instances the processing agency has knowledge about the credibility and reliability of the information that is not available to the collecting agency. The proc-

essor assigns his own evaluation rating to each item of information. The evaluation rating system explained below is used to indicate the reliability of information sources and the probable accuracy of the information itself.

(1) *Reliability of source.*

- A—completely reliable
- B—usually reliable
- C—fairly reliable
- D—not usually reliable
- E—unreliable
- F—reliability cannot be judged

(2) *Degree of accuracy.*

- 1—confirmed by other sources
- 2—probably true
- 3—possibly true
- 4—doubtful
- 5—improbable
- 6—truth cannot be judged

(3) *Examples of use.*

- A-1 completely reliable, confirmed by other sources
- B-3 usually reliable, possibly true
- D-4 not usually reliable, doubtful

c. Interpreting. Interpretation is the process of critical analysis: it is judging information in the light of previously acquired knowledge and experience and determining its significance in terms of capabilities, limitations, and courses of action. The intelligence officer must decide what the data means when compared with what is already known: he must decide whether it verifies, alters, adds significance to, or refutes information already processed and whether it tends to confirm or change the existing estimate of a situation. Interpretation consists of analysis and integration.

(1) *Analysis.*

- (a) Analyzing information consists of sorting the information and arranging the same or related subjects in basic groups. This systematic arrangement facilitates a critical comparison of the elements and clarifies their relationship. Each new piece of information received and processed to the point of interpretation may affect, to some degree, the transportation intelligence estimate: old capabilities may be replaced with new ones, evaluations upgraded or downgraded, and conclusions changed. If conflicting information about the enemy is obtained from sources with the same reli-

bility rating, the possibility of enemy counter-intelligence must be carefully considered.

- (b) Only pertinent information must be integrated into the transportation plan: information that has no possible bearing on transportation should be discarded. Nevertheless before information is discarded as not pertinent, coordination must be effected with other agencies because the information may be pertinent to them.

- (2) *Integration.* Integration is the combining of basic groups of information into a logical and reasonable pattern—the converting of information into true intelligence. This requires judgment and the same type of transportation background that analyzing information requires. Depending upon the situation, the process of integration may be a short mental sifting of pertinent data, or it may be a lengthy and detailed sorting of information.

31. Maintaining Transportation Intelligence

Collectors, processors, and particularly the users of transportation intelligence should never be satisfied with any given status of the intelligence situation. The transportation estimate should be continuously revised and kept up to date in the light of new information received. Because the intelligence process is continuous, close and systematic, liaison with all pertinent agencies, including operating units, is mandatory. To insure the production and maintenance of authentic and timely intelligence—

- a. Question and requestion all enemy personnel.
- b. Obtain and examine new documents and reexamine old ones.
- c. Continue to study and evaluate transportation equipment and facilities.
- d. Evaluate and reevaluate communication systems, terrain, geography, climate, season, weather, hydrology, contaminated areas, and concealment.
- e. Repeat reconnaissance and field trips, including aerial and ground photography.
- f. Maintain contact with military units and civilian agencies.
- g. Maintain continuous liaison with collection agencies.

32. The Transportation Intelligence Estimate

The transportation intelligence estimate is a study that de-

scribes, discusses, and applies interpreted data that are directly or indirectly applicable to the transportation mission. The transportation intelligence estimate helps the commander make sound and timely decisions; it is a part of the overall transportation estimate that is used to formulate the transportation plan. An intelligence estimate is made after all available information has been collected and processed; however, an estimate must be kept current. It must be revised when new or additional information is received and processed. Estimates must be disseminated to appropriate planners in sufficient time to be useful. Should time not permit the making and publishing of formal transportation plans, intelligence estimates may be disseminated directly to the ultimate users—the operating units. Elements that should be considered in a transportation intelligence estimate are listed below. Each estimate will not necessarily contain all of the elements listed: content will depend upon the transportation mission.

a. Statement of the transportation mission.

b. Characteristics of the area of operations that will affect this mission.

- (1) Weather and climate.
- (2) Terrain features.
- (3) Road and rail nets, including traffic bottlenecks.
- (4) Bridges and tunnels.
- (5) Port and beach facilities and wharves.
- (6) Airfields and other aircraft facilities.
- (7) Inland waterways, locks, ports.
- (8) Warehouses and other storage facilities.

c. Characteristics of enemy transportation equipment.

- (1) Locomotive characteristics and inventory.
- (2) Freight and passenger equipment characteristics and inventory.
- (3) Vehicle characteristics and inventory.
- (4) Crane data.
- (5) Waterway craft census.
- (6) Aircraft characteristics and inventory.

d. Transport capability of the enemy: air, water, motor, rail, miscellaneous.

e. Conclusions, including effect of the intelligence estimate on our own forces.

33. Security Classification of Transportation Information and Intelligence

a. Transportation intelligence consists principally of our knowl-

edge of the enemy's transportation system or of transportation systems under his control; this knowledge should be classified if the enemy's awareness of it could help him. We classify documents and materiel that deal with our own forces to deny the enemy knowledge concerning them; it follows that we must exercise the same caution in denying the enemy our intelligence about his forces. Failure to do this will give him an opportunity to accomplish effective counterintelligence.

b. For information and intelligence not already classified, the degree of classification is determined by the commander of the echelon in which the information originates; subsequent reclassification by higher authority may follow. All transportation personnel must bear in mind that if the enemy is aware of what we know about him, his countermeasures may partly or completely neutralize our intelligence effort.

Section V. DISSEMINATION AND USE OF INTELLIGENCE

34. Objective

Intelligence may be used as a basis for command decisions; it must be available in sufficient time to be useful. The primary objective of dissemination is the timely placing of intelligence in the hands of the ultimate user for the formulation of capability estimates and operational plans.

35. Methods

Intelligence required by specific transportation sections or units is disseminated to them through staff, technical, and command channels (fig. 2). Exchange of intelligence with intelligence agencies of other branches and services is through the G2 of the command. Media used to disseminate intelligence depend upon the detail, pertinence, urgency, and intended use of the intelligence. Transportation intelligence may be disseminated by any of the means outlined in FM's 30-5, 30-16, and 101-5. Methods of dissemination are formal reports, documents, maps, photographs, informal messages, displays and exhibits, personal contacts, and telecommunication systems. Figure 3 shows dissemination agencies and important uses of transportation intelligence. Media commonly used to disseminate transportation intelligence are described below.

a. *National Intelligence Surveys.* Transportation sections of the National Intelligence Surveys contain intelligence on railways, motor transport, water terminals, inland waterways, and aviation

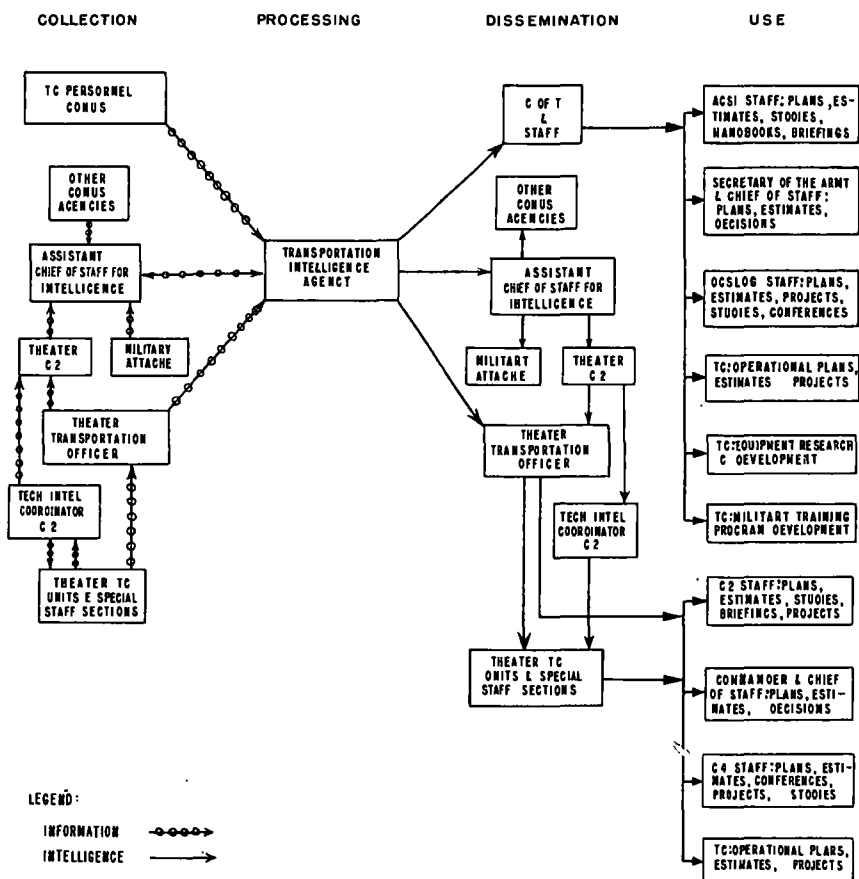


Figure 3. Intelligence Produced by the Transportation Intelligence Agency.

produced by the Office of the Chief of Transportation in coordination with the Corps of Engineers and Office of Naval Intelligence. Other sections of these surveys contain intelligence on subjects of interest to, but not the responsibility of, the Transportation Corps, such as pipelines and airfields.

b. Transportation Intelligence Summary. Periodic summaries of current transportation intelligence are prepared by transportation special staff sections. Such summaries are provided the Assistant Chief of Staff for Intelligence; the transportation staffs of higher, lower, and adjacent headquarters; and other interested agencies as authorized by the Assistant Chief of Staff for Intelligence.

c. Recurring Reports.

- (1) *The intelligence summary.* This summarizes in telegraphic style intelligence for a specified period.
- (2) *Periodic intelligence reports.* These are written reports that cover a longer period than an intelligence summary.

d. Studies and Reports Made as Required.

- (1) *Special transportation studies.* Special transportation studies prepared by the office of the Chief of Transportation and by field agencies on railways, motor transport, water terminals, inland waterways, and aviation are given limited distribution. These studies are analyses of basic transportation facilities and resources as they relate to given operational situations in actual or potential areas of military operations. Transportation studies prepared by theaters and armies encompass smaller areas and normally contain more detailed and up-to-date intelligence on specific routes and modes than studies prepared by the Office of the Chief of Transportation.
- (2) *Climatic studies.* These studies are prepared by supporting Air Weather Service detachments.
- (3) *Spot reports.* Spot reports contain information and intelligence that must be disseminated immediately.
- (4) *Prisoner-of-war interrogation and translation reports.*
- (5) *Photointerpretation reports.*
 - (a) *Immediate.* Supplement oral spot reports.
 - (b) *Mission review.* Contain a summary of information and intelligence on installations, activities, and areas.
 - (c) *Detailed.* Contain precise information and intelligence based on photography and other sources.
 - (d) *Summary.* Consolidate information and intelligence from earlier photographic reports.
 - (e) *Special.* Prepared as required at corps and higher headquarters.
- (6) *Summaries of weather and climate.* Usually prepared by supporting Air Weather Service detachments.
- (7) *Technical intelligence bulletins and summaries.* Report results of examination of enemy equipment and facilities.
- (8) *Order of battle books and handbooks.* Contain information and intelligence on foreign units and nations.

e. Operation Plans and Orders. Paragraph 1 of the intelli-

gence annex of operation plans and orders is commonly used to disseminate information and intelligence.

36. Uses

a. Strategic Planning. Intelligence concerning transportation modes, systems, facilities, and materiel is an essential element in the making of strategic plans. Other intelligence affecting the making of these plans pertains to terrain (rivers, mountains, deserts, swamps, forests, etc.), weather and climate, and the agricultural and industrial economy of the theater of operations. Transportation Corps personnel concerned with transportation planning and intelligence activities use transportation intelligence to determine the capabilities, vulnerabilities, and probable uses of transportation facilities by the enemy. Intelligence is also used to determine the capacities, capabilities, and potentialities of the use of foreign transportation facilities by our own and friendly military forces. Strategic intelligence planning is usually the result of assembling and studying a large volume of detailed information; it is normally accomplished at field-army level or above. At the beginning of military operations, the greater part of strategic intelligence is derived from studies of maps; ports and beaches; rivers; towns and terrain features; lines of communication; and technical, economic, operational, and communications intelligence summaries. Sociological, political, and biographical intelligence summaries are also of vital importance to strategic planning.

b. Tactical Planning. Transportation intelligence is essential for planning tactical operations because it includes terrain features, road nets and their condition, bridges and other structures affecting movement, weather and climate, and other considerations affecting tactical movement by the enemy or friendly forces. Transportation intelligence may also include knowledge about enemy installations and equipment suitable for the tactical use of our forces. Anticipation of intelligence needs is a part of tactical planning: information about items of current interest and those of probable value in the immediate future should be collected and analyzed. The intelligence obtained is normally used at corps level and below.

c. Research and Development. Transportation intelligence developed in peacetime, as well as that developed during hostilities, is a great aid in the research and development of transportation concepts, materiel, and facilities. Captured enemy plans, facilities, or equipment provide research and development personnel with valuable knowledge about the enemy's status of supply, technological advancement, and ability to wage war. This knowledge

is a factor in the timely development of appropriate counter-measures. Research and development intelligence is normally used in CONUS by the Director of Research and Development, in coordination with the other assistant secretaries of the Army. The military chiefs in the Department of the Army who are primarily concerned with this intelligence data are the Assistant Chief of Staff for Intelligence, the Chief of Research and Development, the Deputy Chief of Staff for Logistics, and the Chief of Transportation. Transportation research and development is accomplished at class II installations under the Chief of Transportation. The Army research and development program is coordinated with the Air Force, Navy, and other interested governmental agencies.

APPENDIX I

REFERENCES

1. DA Pamphlets

DA Pam 20-79	Individual Training: Defense Against Enemy Propaganda
DA Pam 20-291	Effects of Climate on Combat in European Russia
DA Pam 30-26	A Guide to the Collection of Technical Intelligence
DA Pam 30-50-1	Handbook on the Soviet Army
DA Pam 30-50-2	Handbook on the Satellite Armies
DA Pam 30-51	Handbook on the Chinese Communist Army
DA Pam 30-100	Intelligence Collection Guide: Telecommunications (U)
DA Pam 30-101	Communist Interrogation, Indoctrination, and Exploitation of Prisoners of War
DA Pam 30-102	Intelligence Collection Guide: Identification of SMD (U)
DA Pam 30-103	Intelligence Collection Guide for Joint Usage; Infrared (U)
DA Pam 30-104	Intelligence Collection Guide: Transportation
DA Pam 30-105	Intelligence Collection Guide, Chemical, Biological, and Radiological Warfare (U)
DA Pam 30-110	Department of the Army Consolidated Statement of Intelligence Requirements (U)
DA Pam 30-115	Weapons and Equipment Recognition Handbook, Middle East
DA Pam 39-2	The Effects of High-Yield Nuclear Explosions
DA Pam 39-3	The Effects of Nuclear Weapons
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings
DA Pam 310-series	Military Publication Indexes

2. Army Regulations and Special Regulations

AR 220-50	Regiments; General Provisions
AR 220-60	Battalions, Battle Groups, Squadrons; General Provisions

AR 220-70	Companies; General Provisions
AR 320-5	Dictionary of United States Army Terms
AR 320-50	Authorized Abbreviations and Brevity Codes
AR 345-274	Records Administration; Intelligence and Security Administration Files
AR 380-5	Safeguarding Defense Information
AR 380-8	Policy Guidance for Security of Special Forces Activities
AR 380-15	Safeguarding Classified NATO Information (U)
AR 380-16	Safeguarding Classified Central Treaty Organization Information (U)
AR 380-17	Safeguarding Classified SEATO Information (U)
AR 380-31	Classification of Aerial Photography
AR 380-46	Radiation of Intelligence Bearing Information by Communications, Communications Security, and Duplicating Equipments (U)
AR 380-55	Safeguarding Defense Information in Movements of Persons and Things
AR 380-83	Civil Censorship
AR 380-150	Security of Restricted Data
AR 380-165	Security Classification Assignments of Identification Friend or Foe (IFF) Information and Equipment (U)
AR 380-200	Armed Forces Censorship
AR 381-1	Control of Dissemination and Use of Intelligence and Intelligence Information (U)
AR 381-7	Requests for Intelligence Documents
AR 381-12	Subversion and Espionage Directed Against U.S. Army and U.S. Army Personnel (U)
AR 381-25	Army Intelligence Collection Instructions (U)
AR 381-28	National Intelligence Surveys
AR 381-45	Military Intelligence
AR 381-100	Counterintelligence Corps; Mission and Employment (U)
AR 381-115	Counterintelligence Investigative Agencies
AR 381-127	Priority of Counterintelligence Investigations
AR 381-131	Counterintelligence Investigations; Procedures and Reports (U)
AR 381-141	Provisions for Administration, Control, Supervision, and Utilization of Intelligence Contingency Funds (U)

AR 381-205	Procedures Facilitating Intelligence Exploitation of Captured Enemy Personnel (U)
AR 381-220	(Title Classified)
AR 614-32	Restrictions of Assignment and Travel of Personnel Having Access to Special Intelligence (U)
AR 640-98	Filing of Adverse Matter in Individual Records and Review of Intelligence Files Consulted Prior to Taking Personnel Action
AR 705-8	Department of Defense Engineering for Transportability Program
SR 380-160-12	Investigation and Clearance of Foreign Personnel Entering the United States Under Auspices of Joint Intelligence Objective Agency (U)
SR 380-160-13	Investigation and Clearance of Aliens in the United States Army (U)
SR 380-305-10	Standardization of Photo Intelligence Reports, Designation and Content
SR 605-150-30	Intelligence Specialization

3. Field Manuals

FM 3-130	U.S. Army Chemical, Biological and Radiological (CBR) Intelligence (U)
FM 5-30	Engineer Intelligence
FM 5-36	Route Reconnaissance and Classification
FM 11-30	Signal Corps Technical Intelligence
FM 11-40	Signal Corps Pictorial Operations
FM 19-40	Handling Prisoners of War
FM 21-5	Military Training
FM 21-6	Techniques of Military Instruction
FM 21-26	Map Reading
FM 21-30	Military Symbols
FM 21-31	Topographic Symbols
FM 21-77	Evasion and Escape
FM 30-5	Combat Intelligence
FM 30-7	Combat Intelligence, Battle Group, Combat Command, and Smaller Units
FM 30-10	Terrain Intelligence
FM 30-15	Intelligence Interrogation (U)
FM 30-16	Technical Intelligence
FM 30-19	Order of Battle Intelligence
FM 30-28	Armed Forces Censorship (Army)
FM 30-30	Aircraft Recognition Manual

FM 30-101	Aggressor, the Maneuver Enemy
FM 30-102	Handbook on Aggressor Military Forces
FM 30-103	Aggressor Order of Battle
FM 31-25	Desert Operations .
FM 31-71	Northern Operations
FM 33-5	Psychological Warfare Operations
FM 41-5	Joint Manual of Civil Affairs/Military Gov- ernment
FM 41-10	Civil Affairs/Military Government Oper- ations
FM 45-25	Field Press Censorship
FM 54-1	The Logistical Command
FM 55-6	Transportation Services in Theaters of Oper- ation
FM 55-15	Transportation Corps Reference Data
FM 55-21	Rail Transportation Higher Units
FM 55-31	Highway Transportation Service in The- aters of Operations
FM 55-54	Highway Capability Estimating Guide
FM 57-35	Airmobile Operations
FM 101-5	Staff Officers' Field Manual; Staff Organiza- tion and Procedure
FM 101-10, Part 1	Staff Officers' Field Manual; Organization, Technical, and Logistical Data
FM 101-31	Staff Officers' Field Manual: Nuclear Weap- ons Employment
FM 110-101	Intelligence: Joint Landing Force Manual
FM 110-115	Amphibious Reconnaissance

4. Technical Manuals

TM 5-240	A Guide to the Compilation and Revision of Maps
TM 5-243	Cartographic Aerial Photography
TM 5-248	Foreign Maps
TM 5-250	Roads and Airfields
TM 5-260	Principles of Bridging
TM 11-401	Elements of Signal Photography
TM 30-235	Military Intelligence; Civil Censorship (U)
TM 30-245	Photographic Interpretation Handbook
TM 30-246	Tactical Interpretation of Air Photos
TM 30-248	Photographic Interpretation Keys: European U.S.S.R. (U)
TM 30-251	Inventory of Military Photo Interpretation Keys and Related Material (U)

TM 30-258	Photographic Interpretation Keys: Railroad and Highway Bridges (U.S. Naval Photographic Intelligence Series)
TM 30-482	Japanese-English Technical Terms Dictionary
TM 30-495	Chinese-English Glossary; Technical Communication Terms
TM 30-500	Spanish Military Dictionary; English-Spanish, Spanish-English
TM 30-501	Portuguese Military Dictionary; Portuguese-English, English-Portuguese
TM 30-502	French Military Dictionary; English-French, French-English
TM 30-506	German Military Dictionary; German-English, English-German
TM 30-533	Chinese Military Dictionary; Chinese-English, English-Chinese
TM 30-541	Japanese Military Dictionary; Japanese-English, English-Japanese
TM 30-544	Glossary of Soviet Military Terminology; English-Russian, Russian-English
TM 30-546	Glossary of Soviet Military and Related Abbreviations
TM 30-547	Soviet Military Symbols
TM 30-548	Soviet Topographic Map Symbols
TM 32-220	Basic Cryptography
TM 45-225	Field Press Censorship Guidance (U)

5. Technical Bulletins

TB 5-550-2	Compilation of Intelligence on Military Hydrology
TB 380-1	Communications Security; The Plain Language Dilemma (U)
TB 381-1	Combat Equipment Technical Intelligence Bulletin

6. Army Training Tests

ATT 7-32	G-2 Section, Infantry Division
ATT 57-3	G-2 Section, Airborne Division (TOE 57-6 TROTAD)

7. Army Training Programs

ATP 30-15	Military Intelligence Units
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ATP 30-203	Army Training Program for Strategic Intelligence Research and Analysis Units, Teams FA, FB, and FC
ATP 33-301	Army Training Program for Psychological Warfare Units.
ATP 41-200	Civil Affairs and Military Government Groups and Companies
ATP 45-201	Army Training Program for Field Press Censorship Detachments
ATP 55-207	Army Training Program for Transportation Intelligence Teams HA and HB

8. Army Subject Schedules

ASubjScd 5-12	Security of Installations and Work Parties
ASubjScd 6-2	Air Observer Training
ASubjScd 6-4	Combat Intelligence
ASubjScd 17-29	Scout Training
ASubjScd 19-13	Security of Military Installations
ASubjScd 19-14	Security of Vital Installations
ASubjScd 21-7	Intelligence Training
ASubjScd 21-13	Elementary Signal Communications
ASubjScd 30-3	Organization, Mission, and Function of Military Intelligence Units
ASubjScd 30-4	Organization, Mission, and Capabilities of Military Intelligence Specialist Teams
ASubjScd 30-5	Military Censorship Teams
ASubjScd 30-6	Sources of Information Available to Strategic Intelligence Research and Analysis Units
ASubjScd 30-7	Message Center and Communications Security
ASubjScd 30-9	Combat Intelligence
ASubjScd 30-10	Counterintelligence
ASubjScd 30-11	Tactical Terrain Studies
ASubjScd 30-14	Military Intelligence Specialists
ASubjScd 30-15	Advanced Map and Photograph Reading
ASubjScd 30-17	Strategic Intelligence Research and Analysis
ASubjScd 30-19	Document Examination (Unit Training)
ASubjScd 30-20	Intelligence Analysis
ASubjScd 30-21	Investigative Photography
ASubjScd 30-28	Counterintelligence Corps with Division in Attack and Defense
ASubjScd 30-29	Counterintelligence Corps Field Equipment
ASubjScd 30-32	Fingerprinting
ASubjScd 30-33	Identification of Eastern Forces (Unit Training)

ASubjScd 30-34	Intelligence Agencies of Eastern Forces
ASubjScd 30-52	Security of Military Personnel
ASubjScd 30-53	CIC in Maneuvers
ASubjScd 30-54	Port Counterintelligence Operations
ASubjScd 30-55	Intelligence Agencies of the United States
ASubjScd 30-60	Counterespionage
ASubjScd 30-62	Surveillance
ASubjScd 30-63	Observation and Description
ASubjScd 30-64	Defense Against Methods of Entry
ASubjScd 30-65	Collection and Preservation of Evidence
ASubjScd 30-66	Liaison Procedures
ASubjScd 33-2	Propaganda
ASubjScd 33-3	Staff Organization for Psychological Warfare
ASubjScd 33-4	Organization, Mission, Functions, and Capabilities of Psychological Warfare Units
ASubjScd 33-5	Principles of Intelligence for Psychological Warfare
ASubjScd 33-18	Psychological Warfare Units; Field Exercises
ASubjScd 33-22	Clandestine and Intelligence Operations (U)
ASubjScd 33-28	Sabotage (U)
ASubjScd 33-29	Weapons (Including Foreign Weapons)
ASubjScd 44-2	Recognition of Aircraft and Armor
ASubjScd 55-10	Collection of Transportation Intelligence
ASubjScd 55-14	Transportation Intelligence

9. Tables of Organization and Equipment

TOE 3-500D	Chemical Service Organization
TOE 5-500C	Engineer Service Organization
TOE 8-500C	Medical Service Organization
TOE 9-500R	Ordnance Service Organization
TOE 10-500R	Quartermaster Service Organization
TOE 11-500R	Signal Service Organization
TOE 30-15D	Military Intelligence Battalion, Field Army
TOE 30-16D	Headquarters and Headquarters Company, Military Intelligence Battalion, Field Army
TOE 30-17D	Military Intelligence Detachment, Divisional
TOE 30-18D	Military Intelligence Detachment, Corps or Airborne Corps
TOE 30-19D	Military Intelligence Collection Company
TOE 30-21D	Military Intelligence Linguist Company
TOE 30-22D	Military Intelligence Security Company

TOE 30-79C	Photo Interpretation Company
TOE 30-500D	Counterintelligence Corps Service Organization and Military Intelligence Collection Service Organization (U)
TOE 30-600D	Military Intelligence Service Organization
TOE 55-500R	Transportation Service Organization

10. Department of Army Posters

DA Poster 21-1	Code of Conduct
DA Poster 21-100-series	Code of Conduct
DA Poster 380-12	Don't Make Our Country the Target, Protect Defense Information

APPENDIX II

AVIATION INFORMATION REQUIREMENTS

1. Areawide Information

Aviation information of intelligence value includes—

a. A critical estimate of aircraft, their economic importance, potential for military use, and relationship to other modes of transportation.

b. Brief history of the aircraft industry and its development.

c. Capabilities of commercial air transport companies.

d. Inventory of aircraft, including number, types, and characteristics.

e. Location of aircraft observed within the country and the number observed at any one time.

f. Procurement policies and procedures of military ground force units in the acquisition of aircraft.

g. Doctrine.

(1) Present and planned tactical doctrine concerning the use of aircraft in ground force units.

(2) Military agencies responsible for developing doctrine for the employment of aircraft.

(3) Effects or influence of nuclear warfare on current concepts of aircraft operations in the combat zone.

h. Command or control of aircraft.

(1) In each arm or service under both normal and emergency conditions.

(2) Employment.

(*a*) Individually, in groups, or in mass.

(*b*) Purpose: reconnaissance, transport of troops and cargo, medical evacuation, command, courier, liaison, nuclear and CBR warfare (in either a dispensing or detection role), utility purposes, such as aerial wire-laying and radio relay.

(*c*) Use of rotary-wing aircraft in night flights—extent and purpose.

(d) Use of rotary-wing aircraft in ship-to-shore operations.

(e) Special techniques of employment.

i. Organization and training.

(1) Organizational structure. (Tables of organization and equipment show structure.)

(2) Type, number, characteristics and location of aircraft units and their equipment.

(3) Aircraft assignments—in support of ground units or attached on a permanent basis.

(4) Publications: organizational, operational, training, maintenance, etc.

(5) Location of schools for training pilots and mechanics.

(a) Length of course.

(b) Types of aircraft used in training.

(c) Flying hours required to complete training: pre-solo, intermediate, and advanced phase.

(d) Cross training of pilots between fixed-wing and rotary-wing aircraft.

(e) Sources for pilot and mechanic students.

(f) Evaluation of the training program.

(g) Training of ground troops in loading or unloading helicopters.

(h) Training exercises by aircraft units, either alone or with other air or ground units.

(i) Frequency of accidents and their causes.

j. Supply and maintenance.

(1) Organizational structure for supply and maintenance.

(2) Critical items of supply or maintenance.

(3) Average life in flying hours of propellers, rotor blades, engines, transmissions, and other critical items.

(4) Extent to which aircraft unit performs its own maintenance in the field.

(5) Days of supply carried with each unit.

(6) Ratio of maintenance hours to flying hours.

(7) Maintenance procedure based upon number of flying hours, calendar, or as needed.

(8) Major causes for need of maintenance.

(9) Maintenance difficulties and man-hours required to perform routine or periodic inspections or maintenance tasks.

(10) Location and characteristics of facilities for maintenance and/or production of aircraft and repair parts.

(11) Air transportability of light aircraft.

k. Research and development.

- (1) Current trends, policies, and procedures in research and development.
- (2) Types of aircraft in the research and development stage.
- (3) Flight and load-carrying characteristics, capabilities, and limitations of these aircraft.
- (4) Names, background, and significant details of individuals connected with program.

l. Facilities and construction.

(1) Army airfield and heliport characteristics.

- (a) Location and name.
- (b) Type: emergency landing and refueling and rearming strips, advanced landing ground, photographic reconnaissance, troop-carrier, supply and evacuation, heliport. In addition air bases, air depots, and airstrips for liaison aircraft.
- (c) Operational and permanency status: fully operational, limited operational, emergency, permanent, temporary.
- (d) Runways: dimensions, angle of axis to prevailing winds, type of construction, regularity of surface, visibility conditions, lighting of runway.
- (e) Runway approaches: flare angle and glide angle, including height, nature, and location of obstructions beyond each end of runway; prevailing winds.
- (f) Runway shoulders: materials, dimensions, and surfaces.
- (g) Hardstands and taxiways: location, dimensions, surface, revetments, and size of parking area.
- (h) Warmup aprons: location, dimensions, and surface.
- (i) Operational facilities: control tower and equipment, operations and briefing rooms, and other facilities.
- (j) Fuel storage: number, character, capacity, and location of containers; description of dispensing system.
- (k) Housekeeping facilities: offices, living quarters, messing and recreational facilities, utilities—including fire-fighting, roads and walkways, road and railroad connections, communications.
- (l) Repair and maintenance facilities.
- (m) Natural and artificial camouflage.
- (n) Physical condition of installation and facilities.
- (o) Vulnerability to nuclear weapons.
- (p) Safety and security features.

(2) Availability of field lighting, firefighting, and rescue equipment.

(3) Traffic control system and navigational aids.

(4) Materials handling equipment.

m. Personnel.

(1) Military: number of officers, number of enlisted men, degree of training, and morale.

(2) Civilian: number, proficiency, and reserve training status.

(3) Data on key personnel: military and civilian.

2. Technical Data on Individual Aircraft

a. Aircraft characteristics and inventory: number available and types of all aircraft used in support of ground force operations (reconnaissance and observation, cargo, utility, liaison, command, light fixed-wing, rotary-wing, convertiplane, vertical takeoff and landing (VTOL), short takeoff and landing (STOL), amphibious, etc.).

b. Production capabilities.

c. Mobilization capabilities.

d. Make and model: experimental, service test, or production.

e. Characteristics.

(1) Powerplants.

(a) Number.

(b) Location.

(c) Type: internal combustion, jet, turbine, rocket.

(d) Horsepower.

(e) Carburetors, air filters, engine cooling.

(f) Propeller diameter.

(2) Landing gear.

(a) Fixed.

(b) Retractable.

(c) Type: wheels, skids, floats, etc.

(3) Transmissions: type and number, including freewheeling devices and power takeoff.

(4) Empty weights.

(5) Gross weights: normal overload.

(6) Fuel type and capacity.

(7) Lifting surfaces.

(a) Diameter, number, location, direction, and plane of rotation(s) of rotor systems on rotary-wing aircraft.

(b) Number and construction type of rotor blades.

(c) Types of deicing equipment, if any, for rotor blades or other components.

- (d) Stub wings and other airfoils.
- (e) Wing span, area, thickness, shape, taper ratio, etc.
- (8) Method and ease of control.
- (9) Control surfaces.
 - (a) Type and dimensions of tail unit.
 - (b) Rudders.
 - (c) Elevators and ailerons, etc.
 - (d) Flaps, brakes, spoilers, and trim tabs.
- (10) Fuselage.
 - (a) Design.
 - (b) Construction type: strength, materials.
 - (c) New developments.
 - (d) Overall dimensions: length, width, and height.
- (11) Maintenance policies and procedures, ease of maintenance, special equipment required, etc.
- (12) Radio equipment by model.
 - (a) Transmitter.
 - (b) Receiver.
 - (c) Other electronic equipment.
- (13) Cockpit arrangement: instrumentation, friend or foe identification (IFF) device, etc.
- (14) Location and size of cargo or passenger compartments.
 - (a) Length.
 - (b) Width.
 - (c) Height.
 - (d) Cube.
 - (e) Floor loading restrictions.
 - (f) Center of gravity.
 - (g) External cargo facilities, including litters.
 - (h) Location, number, size, and tensile strength of tie-down rings.
 - (i) Methods of loading: hand, ramp, hoist, elevator, etc.
 - (j) Type and size of cargo loading doors or ramps.
- (15) Provisions for towing.
- (16) Takeoff and landing devices.
 - (a) Catapult or JATO devices.
 - (b) Retardation devices—arresting gears.
- (17) Wing-folding or other means of increasing transportability.
- (18) Special equipment.
 - (a) Flight instruments, homing devices, radio, and radar.
 - (b) Deicing and defrosting.
 - (c) Aerial wire laying.

- (d) Litter pods.
- (e) Cargo loading and unloading devices.
- (f) Special containers and drop platforms.
- (g) Airdrop release mechanisms.
- (h) Photographic.
- (i) Armor and armament.
- (j) Equipment for transporting missiles.

f. Performance data.

- (1) Payload: passengers and/or cargo.
- (2) Crew number.
- (3) Speeds: maximum, cruising, minimum.
- (4) Cruising radius or range.
- (5) Ceiling: absolute, servicing, hovering (in and out) ground effect.
- (6) Rate of climb.
- (7) Takeoff distance: ground run to clear 50-foot obstacle.
- (8) Landing distance: ground roll from 50-foot obstacle.
- (9) Autorotational (forced-landing) capabilities and characteristics.
- (10) Approach and takeoff angles.
- (11) High altitude or mountain operations.
- (12) Cold-weather starting and operation.
- (13) Desert and jungle operations.
- (14) All-weather flight provisions.

g. Materials used in aircraft construction.

h. Photographs, sketches, and drawings.

3. Information Sources

a. Documents.

- (1) Charts, technical manuals, field manuals, tables of organization and equipment, organizational tables, or other documents showing organization, mission, functions, and responsibilities of each technical service regarding the use of aircraft in ground force units.
- (2) Military reports, records, documents, texts, plans, and brochures giving aircraft inventories or registrations, current doctrine, control, organization, research and development, and other procedures for the employment of aviation in the ground forces.
- (3) Government reports indicating the number, types, use, and importance of both military and civilian aviation.

- (4) Commercial handbooks, brochures, manuals, catalogs, etc. These documents usually contain types and performance data of both military and civilian aircraft.
- (5) Research and development plans and reports and other technical and scientific publications.
- (6) Aircraft registers or inventories showing number, types, and characteristics.
- (7) Design and construction standards. Basic standards for construction of airfields and heliports may be found in engineering texts, pamphlets, and/or government publications, such as technical manuals, field manuals, etc.
- (8) Airfield construction plans and progress reports.
- (9) Military status reports and/or documents indicating maintenance policies and procedures used for airports and heliports.
- (10) Aerial and ground photographs of aircraft and facilities.
- (11) Aeronautical charts, maps, graphs, etc.
- (12) Newspapers, aviation magazines, and other current periodicals.
- (13) Bills of materials.

b. Agencies.

- (1) Ministry of aviation.
- (2) Ministry of communications.
- (3) Foreign ministry (similar to U.S. State Department).
- (4) Governmental trade organizations.
- (5) Aircraft and/or equipment manufacturers.
- (6) Army, navy, and air force elements.
- (7) Commercial airlines.
- (8) National aeronautics administration.
- (9) Airports and other air terminals.
- (10) Weather, statistical, and tourist bureaus.

4. Estimating Aircraft Movement Capability

a. General. To assess the enemy's capability to move personnel and supplies by certain types of aircraft, the analyst must make assumptions and consider the various factors involved. Some or all of the factors discussed below will apply to a particular problem, depending primarily upon the type of aircraft employed. Assumptions, factors involved, and methods of making capability estimates are given below.

b. Assumptions.

- (1) Aviators and ground crews are proficient.
- (2) Adequate landing and takeoff sites are available.

- (3) Ground handling equipment is adequate.
- (4) Aircraft are used only on tactical missions.

c. Factors Involved. Depending upon the nature of a particular mission, the analyst must consider the following factors.

- (1) *Type and number of aircraft involved.* Helicopters, although inferior to fixed-wing aircraft in speed and range, are especially valuable because of their landing, takeoff, and hovering capability. They can operate in areas that are inaccessible to fixed-wing aircraft and be loaded and unloaded in less time than fixed-wing aircraft. On the other hand, fixed-wing aircraft can generally operate more hours per day with a higher sustained availability.
- (2) *Loading.*
 - (a) Weight of cargo and lift capability (payload) of aircraft.
 - (b) Configuration of cargo in relation to size of cargo compartment and cargo compartment doors.
 - (c) Sling loads for helicopters.
 - (d) Wing loads for fixed-wing aircraft.

- (3) *Hours of daily operation.*

Helicopter	4
Fixed-wing	6

- (4) *Miles in the hour.* Speed plus loading, unloading, and flying time will determine miles in the hour. Operational hours and distance can then be used to compute the number of round trips each aircraft can make. The average loading and unloading times are—

	Helicopter Load or Unload (min)	Fixed-Wing Aircraft Load (min)	Unload (min)
Troop.....	3	2 to 3	1
Casualties.....	10	10	10
Cargo inside.....	5	10 to 30	5 to 15
Cargo on slings.....	0.5	-----	-----
Wing loads.....	---	10	10

- (5) *Daily round trips per aircraft.* This is obtained by multiplying operating hours by miles in the hour and dividing this product by the distance.
- (6) *Availability.* Availability is affected by the adequacy and efficiency of maintenance and supply and the relative location of operating and service units. The average availability of aircraft on hand for sustained and short-term operations is—

	Sustained (percent)	Short-term (percent)
Helicopters -----	67	90
Fixed-wing -----	75	90

(7) *Aircraft requirement.* The aircraft required to accomplish a mission is determined by two factors—the basic requirement and the type of operation.

(a) *Basic.* The number of aircraft needed to meet the basic requirement is obtained by dividing the total tonnage to be moved by the payload of one aircraft of the type to be used in the operation.

(b) *Type of operation.* The basic aircraft requirement figure has to be adjusted according to the variable factors involved. The most common variable factors are—

1. *Distance.* Distance causes the fuel and payload relationship to vary inversely. When the operation exceeds 50 miles, the basic aircraft requirement should be increased approximately 7 percent for each 20-mile increment.

2. *Sustained operations.* In a sustained operation, the basic number of aircraft required should be increased by 50 percent.

3. *Combat loading.* A 10 percent increase of the basic requirement is necessary for combat loading.

4. *Miscellaneous variables.* As altitude and/or temperature increase the aircraft requirement will also increase because of a decrease in weight-lifting capability. Humidity and other weather conditions also affect the aircraft requirement. Adjustments made because of these variables must be determined by the analyst.

d. *Making the Estimate.* When estimating the enemy's aircraft requirement or the tons he can move daily by aircraft, the formula to be employed and examples of its use are explained below.

(1) *Formula.*

$$A = B \times C \times D$$

where

A = daily tonnage capability

B = daily round trips flown per aircraft

C = payload of one aircraft

D = aircraft employed

(2) *Movement by helicopter.*

(a) *Problem.*

What is the daily lift capability for 1 day of 25 helicopters in the communications zone where—

4 = operational hours

90 = average speed in miles in the hour (includes loading and unloading time)

75 = round trip distance in miles

90 = percent of aircraft available

1.4 = short tons of payload for each aircraft

0.9 = availability of 90 percent

(b) *Solution.*

$$B = \frac{4 \times 90}{75} = 5 \text{ round trips per aircraft}$$

$$A = 5 \times 1.4 \times 25 \times 0.9 = 157 \text{ short tons per day}$$

(3) *Movement by fixed-wing aircraft.*

(a) *Problem.*

What is the sustained fixed-wing aircraft requirement to move 500 short tons of cargo per day a distance of 35 miles under combat conditions where—

1.1 = multiplier for combat loading

1.5 = multiplier for sustained operations

1.4 = short tons of payload for each aircraft

80 = average speed in miles in the hour (includes loading and unloading time)

6 = operational hours per day

(b) *Solution.*

$500 \times 1.1 = 550$ (adjusted tonnage for combat loading)

$$B = \frac{6 \times 80}{2 \times 35} = 7 \text{ round trips per aircraft}$$

$$D = \frac{550 \times 1.5}{7 \times 1.4} = 84 \text{ aircraft for sustained operations}$$

APPENDIX III

INLAND WATERWAY INFORMATION REQUIREMENTS

1. Areawide Information

Essential information of intelligence value about inland waterways includes facts about the topics outlined below.

a. Importance of navigable inland waterways (rivers, inland lakes, inland channels, canals) and waterway transportation in the country or area, including—

- (1) Place in the national economy, including relationship to industry and agriculture and to other modes of transportation.
- (2) Ownership, history of development, and influencing factors, including an account of war damage and rehabilitation.
- (3) Relationship to port, beach, and landing area facilities and operations, including potentialities for major improvement or development for military purposes.

b. Description and analysis of the waterway transportation system including—

- (1) Indication of the geographical distribution of navigable inland waterways, including intracoastal waterways, and an explanation of the country's waterway classification system.
- (2) Small scale annotated maps, charts, and diagrams indicating the name and navigable length of each waterway; principal ports and landing places; passing basins and tieup areas; ferry crossings and stations; dams, bridges, aqueducts, locks (single and double), tunnels, and other critical features; major repair and servicing facilities; and location of controlling channel depths, widths, and clearances.
- (3) Tabulation of waterway mileages by systems, individual waterways, operating divisions, and type of waterway.
- (4) Details of inland waterways' communication and dispatching systems and facilities.
- (5) Discussion of official construction standards for inland

waterway canals and waterway facilities and the extent to which the standards are followed.

- (6) Details of status and scheduling of current projects and proposed plans for the development or improvement of inland waterways and waterway transportation.
- (7) Details of the waterway network: operating condition, limitations, capacities, and military potentialities.
- (8) Details of the organization, training, operations, and capabilities of inland waterway transportation units in the country's military service, including tables of organization and equipment, training literature and related doctrine.
- (9) Explanation of local terminology used to describe inland waterways and waterway transportation activities and facilities.

c. Organization and administration of inland waterway and waterway transportation.

- (1) Ownership, funding, regulatory controls imposed by government, and extent of foreign influence and interests.
- (2) Location, organization, and functions of agencies responsible for control and administration of inland and intracoastal waterway transportation.
- (3) Number of waterway administrative personnel by departments and divisions; their training, education, technical qualifications, and efficiency.
- (4) Size and quality of the skilled and unskilled labor force, centers where recruited, training and experience, working conditions and wage scales, organization of crews, attitude toward Americans, and dissident and sympathetic elements.
- (5) Financial statistics including waterway rates, operating revenues and expenses, and foreign financial aid received for waterway development.

d. Waterway operations data.

- (1) Operating regulations, methods, and standards for freight and passenger traffic and methods of documentation.
- (2) Operating statistics tabulated and analyzed for each waterway and for the network as a whole including data about—
 - (a) Total freight ton-miles of cargo transported and passenger-miles traveled.

- (b) Total tonnage by commodity.
- (c) Average time and distance of freight haul.
- (d) Average vessel turnaround time.
- (e) Average freight (net tons) and/or passengers hauled per unit.
- (f) Maximum number of vessels, by type, which are operated over the various routes, in each direction, during normal and peak periods; potential traffic.
- (g) Average loading and discharge rates.
- (h) Size and type of tows.
- (i) Maximum permissible length, draft, beam, and load of vessels using the route.
- (j) Mileages and terminals for operating divisions or sections of the route, if so designated.
- (k) Tabulations showing incidence of major traffic interruptions by type, cause, season, and area.
- (l) Tonnages handled at principal loading, unloading, and transfer points.
- (m) Determination of throughput capacity.

- (3) Discussion of major transport organizations: location of offices, vessels owned and operated, routes used, nature and volume of traffic, repair and servicing facilities, communication and dispatch facilities, and efficiency of operations and maintenance in general and in terms of vessels deadlined.

e. Waterway craft statistics.

- (1) Waterway craft census for each waterway and/or for the waterway network as a whole.
- (2) Special equipment census for each waterway and/or for the waterway network as a whole.
- (3) Number, type, and characteristics of waterway craft and other waterway equipment manufactured, imported (from whom), and exported (to whom) annually, including towed and self-propelled barges and tankers, tugs and towboats, floating cranes, landing craft, floating machine shops, passenger and cargo vessels, dredges, and icebreakers (app. V, par. 2b(14)).

f. Waterway transportation research and development (civil and military).

- (1) Research and development policy, funding, objectives, and capabilities.
- (2) Testing and development centers, facilities, equipment, and key personnel.

- (3) Current waterway research and development projects and progress; important past accomplishments including evaluation of effectiveness.

2. Detailed Description of Individual Waterways

a. Route Identification and Details.

- (1) *Identification.* Waterway name, location, characteristics, and relationship to other waterways and to other modes of transportation. Information should include—
 - (a) Type of waterway: lake, river, canal.
 - (b) Description of adjacent terrain: delta, marsh, hills, mountains, desert, jungle.
 - (c) Dimensions of waterway: length, width, depth. If necessary, attach a sketch of major deviations with dimensions.
 - (d) All channel locations.
 - (e) Source of water for waterway: streams, seasonal rains, pumping stations.
 - (f) Dates when waterway is open and closed because of such conditions as freezing, flood, low water, repairs.
 - (g) Branches: location, name, navigability.
 - (h) Silting characteristics.
 - (i) Composition of bottom and sides: clay, gravel, mud, concrete, stone, vegetation. Cross-sectional sketches are useful.
 - (j) Embankments: location, height, and composition.
 - (k) Passing basins and areas: location, size, depth.
 - (l) Obstructions. Nature of obstructions: tidal bores, rapids, reefs, sandbars, whirlpools, wrecks, shoals, narrows, snags, scouring, landslides, excessive vegetation. Effect of obstructions on navigation and methods of bypassing, such as pilotage, towing from shore, and poling.
- (2) *Approaches and entrances.* Usual method of approach, nature of approach, and conspicuous objects; controlling depth and width of channel across bar, shoals and alternate channels; and any critical or unique feature.
- (3) *Tides and currents.* Mean and spring tidal ranges; upper limit of tidal rise (mile station); seasonal water level variations; average speed of current by seasons.
- (4) *Navigability.* Total length and navigable length (if a lake, area and maximum length and width); navigation limits for vessels of different drafts and characteristics; seasonal controlling widths and depths, distinguishing

between total width of river and width of navigable channels; effect of obstacles and other hazards; duration of navigable season and normal closing date.

(5) *Channel (attach charts).*

(a) Depth and bottom width, with seasonal variations and flood stages. Give character of bottom and known obstructions.

(b) Character of banks, including overhanging vegetation.

(c) Critical bends: location, degree of bend, visibility.

(d) Aids to navigation, such as buoys, lights, range marks, and foghorns.

(6) *Effect of wind on waterway.*

(7) *Effect of seasonal changes.*

b. *Structures and Facilities.*

(1) *Aqueducts.* Location (mile station, coordinates, etc.), length and width, height above stream or obstacle overpassed, and construction details.

(2) *Dams and reservoirs.* Location, design, construction material, purpose, means of bypassing; hydroelectric powerplants, and seasonal variations in water supply.

(3) *Pumping stations.* Function, location, construction, arrangement, dimensions, and power used.

(4) *Ferries and ferry stations.* Location, type, power, service rendered, capacity, operating schedules, technical details, and extent of interference with other waterway traffic.

(5) *Bridges.* Type (material, construction, fixed or movable), location, use, underbridge horizontal and vertical clearances at mean low water (MLW) and mean high water (MHW), type movable span (single or double swing, bascule, lift, central island turntable, retractile), and opening and closing times.

(6) *Safety gates.* Location, action of gates (mitering, lift, taintor), construction material and condition, and clearances.

(7) *Tunnels.* Location, length, horizontal and vertical clearances (seasonal), how vessels are powered through tunnel (towed, poled, pushed, self-propelled), minimum radius of curvature, and time required to traverse.

(8) *Shiplifts.* Location, dimensions of movable chamber, depth over sills of chamber, construction design and material, difference in water levels to overcome, time

required to pass through the lift, special details of operation (power) and construction.

- (9) *Inclined planes.* Location, construction (design and material, claylined, watered), hoisting device (hand-powered or mechanically-powered), and passage time.
 - (10) *Passing basins and anchorages.* Location, size, depth, type of bottom, type and size of vessel berths, and controlling clearances.
 - (11) *Miscellaneous restrictions.* Location, details, and clearances, including power lines, telephone wires, cable crossings, mines, and other limiting features.
 - (12) *Waterway locks.* Information should include name, location, lifts, inside dimensions of chamber, depth over sill, type of gates, time to fill and clear, type of operating machinery, aids to navigation at lock, approaches and approach structures.
 - (13) *Heavy floating machinery.* Dredges, yards, and construction materials, available for improving the waterway and its allied facilities.
 - (14) *Vessel repair facilities.* Location, character, and capacity of these facilities.
- c. *Inland Waterway Ports.* Information should include—
- (1) Identification of waterway: name or number.
 - (2) Name and location (coordinates) of port, map reference number.
 - (3) Approach channel: controlling depth and average width.
 - (4) Harbor: type, area, and depth.
 - (5) Berthage: type, construction material, total length, alongside depths, and width of apron.
 - (6) Storage space: warehouses (square feet of floor space), open (square feet of ground or floor space), bulk grain (bushels), cold (cubic feet), bulk oil (barrels).
 - (7) Cranes: total number and heaviest lift.
 - (8) Port clearance facilities: rail and highway.
 - (9) Date and source of information.
- d. *Features and Conditions Affecting Operations.*
- (1) Waterway traffic data.
 - (a) Average number, type, size, and capacity of vessels moving in each direction daily, monthly, and annually; passengers and tonnages transported; average net load; running time; speed; and vessel turnaround time by types.

- (b) Running time and distance between all important points on waterway.
- (2) Necessity for, pay, efficiency, and availability of local civilian pilots.
- (3) Irrigation practices and effects on navigation water levels.
- (4) Rules and regulations for use of waterway: those affecting rates; documentation; communication and dispatching; maximum permissible length, draft, beam, and load; maximum number of vessels, by type, normally permitted to use route in each direction.
- (5) Construction and maintenance: responsible organization or agency; policies, procedures, and scope of activities; labor and administrative personnel.
- (6) Principal users of waterway: identification and location, organization, vessels owned and operated, nature and volume of traffic.
- (7) Incidence of traffic interruptions: type, cause, season, and area of occurrence.
- (8) Navigational aids and towing facilities: location and type of buoys, bells, lights, etc.; availability of towing equipment and type (push, pull, alongside, shore).

3. Information Sources

a. *Documents.* Documents of the type described below are required for inland waterway transportation planning and intelligence purposes. These documents should be sent to the Transportation Intelligence Agency, Washington 25, D. C., and when required, the intelligence elements of transportation sections at other levels of command.

- (1) *Hydrographic charts.* Charts of harbors show water depths, channels, islands, character of bottom, berthing facilities, and aids and hazards to navigation. Hydrographic charts shows topography of the shore, including salient features that aid navigation and berthing. These charts are issued on national and local levels. They are supplemented by publications similar to "Sailing Directions," "Pilots," and "Tide Books."
- (2) *Inland waterway terminal plans.* Inland waterway terminal plans are accurate, large scale drawings or representations showing the general overall layout with details of berthing, cargo handling, and storage facilities; beaches; feeder canals and tidal creeks; rail, road, and

waterway connections and structures; and the location of important servicing installations and repair facilities.

- (3) *Port publications.* Descriptive brochures are frequently issued by the port authority. The several companies operating the various installations at a port also issue brochures to attract business. In addition to these brochures, there are local chamber of commerce or board of trade statements and advertisements that point out advantages of a particular port.
- (4) *Route logs, maps, and charts.* Such publications contain information concerning inland waterway locations, alignment, depths, lock characteristics, limits of navigability, crossings and overhead clearances, navigational aids and hazards, ports and landing areas, traffic bottlenecks, and other essential operating data, by mile or kilometer stations.
- (5) *Craft census.* Inventories of harbor craft and floating equipment including lighters, tugs, powered vessels, barges, and construction and maintenance craft, such as icebreakers, floating pile drivers, dredges, draglines, and floating cranes.
- (6) *Traffic studies and statistics.* Statistical analyses of port activities may be found in both national and local economic surveys, almanacs, and yearbooks. They furnish information on volume unloaded and loaded, and provide a key to reception, discharge, storage, and clearance capabilities of the port as well as the number, type, draft, dimensions, and tonnage of vessels using the port during normal and peak traffic periods.
- (7) *Guides to internal navigation.* Shipping registers; shippers' almanacs; national pilots; reports of inland waterway boards; and guides to internal navigation are publications which give information on inland and coastal waterway routes and their characteristics, ports, locks, and limiting factors; shipping of all types including inland waterway, coastal waterway, and ocean shipping; and general operating rules, regulations, and procedures.
- (8) *Documentation of freight.* Samples of shipping documents, bills of lading, rules for marking containers, and related freight documentation material are of value for transportation planning and intelligence purposes.
- (9) *Design and construction standards.* Basic standards for design and construction of port and inland waterway

facilities and equipment may be found in engineering texts and governmental and equipment manufacturers' brochures. Such publications may contain information concerning national or regional standards for pier or quay construction, vessel and cargo handling equipment characteristics, transit storage facilities, lock construction, and other marine facilities.

- (10) *Construction plans and progress reports.* Overall port and waterway improvement policy and programs; current and proposed port and waterway improvement plans including projects planned, completed, or underway; and dated progress reports on all such projects.
- (11) *Aerial (vertical and oblique) and ground photographs.* Photographs are essential—particularly closeup views of wharves and cargo handling facilities and equipment; road, rail, and waterway clearance facilities and equipment; locks, vessels, transit storage, and vessel repair facilities; floating equipment; vessels working at alongside and anchorage berths; beaches and exits; and principal limiting structures. Vertical aerial photographs in stereoscopic pairs taken so as to provide scales of 1 inch equal to 500 feet to 1 inch equal to 1,000 feet provide sufficient detail to satisfy most requirements.
- (12) *Tide and current tables.* Tide tables give the difference in water level at different points caused by tidal action. Current tables show the force and direction of currents within a waterway.
- (13) *Hydrographic discharge graphs and tables.* Discharge graphs and tables show the volume of discharge, or volume of water, (expressed in cubic feet or cubic meters per second) that passes a given point. Data usually show monthly discharge rates for an average year and for monthly peak periods.
- (14) *Waterway profiles and cross sections.* These are scaled drawings which show the sectional differences in elevations of a waterway from a datum point, usually at sea level. Distances are generally expressed in miles or kilometers and elevations in feet or meters. Drawings range from simple, as for a natural stream, to very complex, as for the location of a complex of engineering works.
- (15) *Lock tables.* Lock tables give location, length, and width of chamber; depth over sill; amount of lift; type of gates and number; and other data about the locks on specific waterways.

- (16) *Structure plans.* These are scaled engineering drawings that give the structural characteristics and dimensions of construction projects. They are usually of dams, locks, and bridges.
- (17) *Rules of the road.* All vessels are subject to nautical rules of the road. Inland and pilot rules prescribe procedures on inland or coastal waterways. Rules of the road govern the display of lights; fog, passing, and day signals; speed; buoyage system; and other vessel procedures.
- (18) *Vessel diagrams.* These drawings or blueprints show the features or design characteristics of a particular craft. They are usually found in manufacturers' brochures and technical magazines.
- (19) *Traffic flow charts.* These charts show tonnage movement on individual waterways or through ports.
- (20) *Inland waterway directories and yearbooks.* Tables, listings, charts, and narrative material about the activities of governmental agencies responsible for inland waterway matters are often found in directories and yearbooks pertaining to inland waterways. These are published by both governmental agencies and private companies. These publications may also contain information on waterway characteristics, inland ports, individual operating companies, and associations of water transport operators.

b. Agencies.

- (1) Port authorities.
- (2) Construction and maintenance engineers and contractors.
- (3) Statistical and inland waterway transportation bureaus.
- (4) Ministries of transportation and public works.
- (5) Commercial waterway carriers.
- (6) Military planning and operating sections and units.
- (7) Shipping companies, operators, employees.
- (8) Waterway transport organizations.
- (9) Governmental agencies comparable to U.S. Departments of Labor, Commerce, and Interior; Bureau of Internal Revenue; Hydrographic Office; and Maritime Administration.

4. Estimating Movement Capability by Inland Waterway

The actual capacity of a waterway, the availability of craft, and the adequacy of terminal facilities are factors that must be considered when estimating inland waterway movement capability. Any of these factors may limit an inland waterway operation; each

one must be examined to determine its impact upon the waterway movement capability. It is necessary, in the absence of definite information, to make certain assumptions when estimating inland waterway movement capability. The necessary assumptions, factors involved, and formulas for estimating movement capability are explained in this paragraph.

a. *Assumptions.* It is assumed that :

- (1) Waterway is usable.
- (2) Weather is favorable.
- (3) Civilian use of the waterway has been restricted to essential traffic.
- (4) Manpower and fuel are available and adequate.
- (5) Vessels are weight-loaded to 60 percent of capacity.
- (6) Average deadline rate is 20 percent.
- (7) Waterway operations are 15 hours per day.
- (8) Average speed is 4 miles per hour.
- (9) Port operations are 20 hours per day.
- (10) Cargo handling averages 30 tons per hour per barge.
- (11) Average locking cycle is 45 minutes.
- (12) Empties pass through the locks on the return trip.
- (13) Effect of current is ignored.
- (14) Cargo movement is only in one direction.

b. *Waterway Movement Capability.* There are two types of waterways—open and restricted. For the purpose of this discussion, lakes, rivers, channels, canals, and other navigable inland bodies of water that do not have locks or other restrictive features are termed “open waterways,” whereas waterways that have locks or other restrictive features are termed “restricted waterways.” Types of waterways and how to estimate movement capability over them are explained below.

- (1) *Open waterways.* In general, open waterways can accommodate a large volume of traffic. The Mississippi River is an example of such a waterway: tows on the lower Mississippi and on the Ohio Rivers are usually a quarter of a mile long. Movement is limited only by availability of craft and adequacy of terminal facilities.
- (2) *Restricted waterways.* An inland waterway that has locks or other restrictive features, such as narrow bridge spans or narrow passageways, is a restricted waterway. A passageway may be naturally narrow or narrowed by the number and/or width of bridge spans. Such restrictive factors may be the most limiting factor in an inland waterway movement. For example, if there is only one

underbridge passageway, the safety factor between tows is the governing factor. (The safety factor between tows may vary from 1,000 to 2,000 feet.) Changing the number of tows per mile can make a great difference in movement capability.

(3) *Movement capability formulas.*

- (a) *General.* The formulas given below may be used to determine movement capability over waterways. In these formulas and the formulas for determining barge and tug requirements discussed in c below, the letters used have the following meanings:

- A* = number of barges
- B* = tons per barge
- C* = percentage of usable barges
- D* = factor for military loading (This is the reduction factor that must be applied to each operation: it is determined by the loading and unloading of personnel, equipment, and facilities available.)
- E* = one-way distance in miles
- F* = navigating-operating hours per day
- G* = average speed in miles per hour
- H* = actual load of one barge in tons
- I* = port-handling rate in tons per hour
- J* = length of port-working day in hours
- K* = number of locks
- L* = length of longest locking cycle in minutes
- M* = lock-operating hours per day
- N* = tows per mile
- O* = number of passages per day
- P* = daily tonnage requirement
- Q* = turnaround time in days for barges
- R* = number of barges per tow
- S* = turnaround time in days for tugs

- (b) *Turnaround time.* The turnaround time in days for barges and tugs used in the formulas below is the sum of navigating time, port time, and lock time. Methods of determining these times are:

$$\text{Navigating time} = \frac{E \times 2}{F \times G}$$

$$\text{Port time} = \frac{H \times 2}{I \times J}$$

$$\text{Lock time} = \frac{K \times L}{M \times 60}$$

- (c) *Formula for open waterway.* A simple capability formula applicable only to open waterways is—

$$\text{Capability in tons per day} = N \times G \times F \times B \times D$$

- (d) *Formula for restricted waterway.* When the waterway is restricted but the number of possible passages per day is known, a simple capability formula is—

$$\text{Capability in tons per day} = B \times O \times D$$

- (e) *Formula for both open and restricted waterways.* If the number of possible passages per day is not known, but the basic information (information represented by the letters A through M in (a) above) is available, the following formula may be used to determine movement capability over an open or restricted waterway. Capability in tons per day =

$$\frac{A \times B \times C \times D}{\frac{E \times 2}{F \times G} + \frac{H \times 2}{I \times J} + \frac{K \times L}{M \times 60}}$$

Example: How many tons of military stores per day can be moved on a 300-mile waterway that has 10 locks if—

One hundred 1000-ton capacity, self-propelled barges are available

The percentage of usable barges is 80

The factor for military loading is 0.6

Navigating-operating hours per day are 15

Average speed is 4 miles per hour

Load of each barge is 600 tons

Port-handling rate per hour is 30 tons

Length of port-working day is 20 hours

The locking cycle is 45 minutes

Lock-operating hours per day are 15

$$\text{Capability} = \frac{100 \times 1000 \times .80 \times 0.6}{\frac{300 \times 2}{15 \times 4} + \frac{600 \times 2}{30 \times 20} + \frac{10 \times 45}{15 \times 60}} = \frac{3840 \text{ tons}}{\text{per day}}$$

c. *Availability of Craft.*

- (1) *Barges.* Investigation must be made to determine if there are enough barges to perform the transportation mission. Barge requirements can be determined after the route capability is computed or the daily tonnage requirements are established. The formulas given below

may be used to determine the number of barges required for open and restricted waterways.

(a) *Open waterway.*

$$\text{Barges required} = \frac{P \times Q}{B}$$

(b) *Restricted waterway.*

$$\text{Barges required} = O \times Q$$

- (2) *Tugs.* When tugs are used, the arrangement of the tows must be considered. It is sometimes possible to operate with fewer tugs than tows because the tugs do not have to wait in port while the cargo is being transferred. Moreover, one tug can often tow more than one barge. In planning a towing operation, the fit of the tow in the locks must be considered. The following formula can be used to determine the number of tugs or towboats required to move the available barges. Number of tugs

$$\text{or towboats required} = \frac{A \times S}{R \times Q}$$

d. *Adequacy of Terminal Facilities.* Port facilities include berthing space and cargo handling equipment. Generally these facilities do not constitute a restrictive factor in an inland waterway movement: usually temporary berthing facilities can be constructed. Without mechanical handling facilities, general cargo can be handled at the rate of 10 tons per hour per barge. This capability can be greatly increased by using forklifts. If forklifts are used, it is safe to assume that 30 tons per hour per barge can be handled. Nevertheless, when existing port facilities are inadequate and it is not possible to improvise additional facilities, the existing port facilities may be the most restrictive factor in the entire movement. In such a case the capability of port facilities will determine the inland waterway movement capability. This problem cannot be solved by using formulas; its solution requires careful analysis and sound judgment.

APPENDIX IV

MOTOR TRANSPORT INFORMATION REQUIREMENTS

1. Areawide Information

Highway information of intelligence value includes—

a. Importance of highways and highway transportation in the country or area, including—

- (1) Place in the national economy; for example, relationship to industry, agriculture, and other modes of transportation.
- (2) Relationship of the main highway system to secondary and tertiary road networks and to port, beach, and landing area facilities.
- (3) Adequacy for country's peacetime and wartime transportation needs; potentialities for major improvement or development for military purposes.
- (4) History of highway development and plans for future development.

b. General description and analysis of the highway transportation system including—

- (1) Geographical distribution of highways and highway transportation facilities.
- (2) Small scale annotated maps, charts, and diagrams showing highway routes, route names and numbers, route lengths (in miles or kilometers), roadway surface types and widths, terminals, junctions, loading and unloading points, critical points, such as key bridges and other important features and facilities.
- (3) Route classification and identification systems.
- (4) Total highway mileage by surface types.
- (5) Surface types and road classification.
- (6) General condition of the highway network, including an analysis of transport capacities, potentialities for military use, and principal limiting factors.
- (7) Scheduling and status of current projects and proposed plans for the development or improvement of highways and highway transportation.

- (8) Details of official construction standards and design specifications for highways, including roadways, bridges, ferries, fords, tunnels and other highway structures and facilities and an analysis of the extent to which standards are followed.
- (9) Type and adequacy of route signs and a description of signs, markers, and special devices used.
- (10) Density of the highway network by regions, in miles per square mile and miles per unit of population.
- (11) Description of the organization, training, operations, and capabilities of highway transportation units in the country's military service, including copies of tables of organization and equipment, field and technical manuals, and related literature.
- (12) Explanations of local terms used in describing highways and highway transportation activities and resources.

c. Organization and administration of highways and highway transportation, including—

- (1) Government policy, organization, and method of control.
- (2) Identity, location, and organizational charts of agencies responsible for control and administration of highway transportation, and a discussion of functions and programs.
- (3) Quantity and quality by departments and divisions of the skilled and unskilled labor force, centers where recruited, training and experience, working conditions and wage scales, and organization of highway personnel.
- (4) Financial statistics: receipts, expenditures, and appropriations for highways and highway transportation.

d. Details of repair, storage, parking, fueling, and other highway transport service facilities including—

- (1) Location and characteristics.
- (2) Capacity, condition, and peacetime and wartime adequacy.
- (3) Operating methods and problems.
- (4) Personnel and special equipment employed.
- (5) Fuel and lubricants in use, including type, source, method of distribution, and annual consumption.
- (6) Source, availability, and adequacy of repair parts.

e. Details of highway transportation activities, including data concerning—

- (1) Government-owned, -operated, or -controlled highway transport activities.
 - (2) Governmental control and regulatory measures: limiting axleloads; limiting vehicle lengths, widths, and clearances; and speed limits.
 - (3) Traffic flow charts and transportation statistics in the form of tabular and graphic presentations, indicating—
 - (a) Main truck and bus routes.
 - (b) Maximum number of vehicles, by types, operated over the various routes during normal and peak periods.
 - (c) Heaviest vehicles using particular routes, preferably in terms of maximum axleloads and frequency of heavy loads.
 - (d) Average freight hauled in net tons per unit.
 - (e) Statistics on passengers and cargo hauled, including ton-mile performance data and distances hauled.
 - (f) Traffic volume in urban areas; through and bypass routes.
 - (4) Major transport organizations.
 - (a) Location of main and field offices.
 - (b) Transportation units owned and operated by each.
 - (c) Operating facilities, personnel, and equipment owned by each.
 - (d) Bus or truck routes used.
 - (e) Efficiency of operations and maintenance in general and in terms of vehicles deadlined.
 - (f) Adequacy of transport operations for national needs.
 - (g) Prevailing passenger and freight rates.
 - (5) Analysis of the principal limitations of the areawide highway transportation system: overall traffic interruption statistics (urban area through-routes and street systems serving ports, landing areas, railroad junctions, airports, etc.) should be included.
 - (6) Description and evaluation of highway transport communication facilities.
- f. Motor vehicle characteristics and inventory.
- (1) *General purpose and combat motor vehicles.*
 - (a) Number, types, and makes of vehicles (trade name when applicable); use; source (foreign or domestic); annual export (to whom) and import (from whom) data; domestic production capacity and ability to meet area needs.
 - (b) General characteristics of each type vehicle: net and

gross weight, overall dimensions, cargo body dimensions, number and arrangement of wheels, number of driving wheels, tread and wheelbase, ground clearance, type of brakes, fuel tank capacity, and loading height.

- (c) Performance characteristics of each type vehicle: maximum speeds and payloads for highway and cross-country; allowable towed-load; gradeability; cruising range, loaded and empty; POL for 100 miles when loaded; number of passengers.

- (2) *Special purpose vehicles and equipment.* Number, by type, and the characteristics, capacities, and condition of the types of vehicles and equipment listed below.

- (a) Vehicles used to carry outsize, odorous, explosive, corrosive, or contaminating cargoes; handling equipment for such cargoes.
- (b) Vehicles such as bookmobiles, mobile post exchanges, mailtrucks, rail autocars, and engineer vehicles, such as cranes and bulldozers.
- (c) Self-loading and unloading devices.
- (d) Conversion kits used to modify vehicles.
- (e) Vehicles and equipment used in arctic, desert, and jungle areas.
- (f) Vehicles that operate on solid fuel.

g. Highway transportation research and development program including—

- (1) Research and development policy, trends, objectives, and capabilities.
- (2) Testing and development centers, facilities, equipment, and key personnel.
- (3) Current research and development projects and progress in the field of highway transportation, and important projects recently completed.

2. Detailed Description of Individual Routes

a. Route identification and description.

- (1) Roadway name, number, length, and importance.
- (2) Road type and classification.
- (3) Details of important junctions, access and egress roads, bypass routes, and detours.
- (4) Details of new construction or improvements planned or underway with dates.
- (5) Tabular data concerning structures and crossings on the route (bridges, tunnels, underpasses, fords, ferries), in-

cluding number, prevailing types, lengths, and load and clearance limitations.

- (6) Distance between all important points.
- (7) Location, length, and maximum interval between turn-outs or passing places on one-way roads.
- (8) An estimate of the operating capacity of the route based upon physical factors (par. 4 below).
- (9) Obstructions, such as craters, roadblocks, mines, and destroyed culverts and bridges.
- (10) Defiles and possible bypasses.
- (11) Extent to which the capacity of the road is needed for normal civilian traffic and for civilian traffic deemed essential under theater policies.
- (12) Visibility to enemy ground observers.
- (13) Vulnerability to nuclear weapons.
- (14) Traffic statistics: monthly and annual traffic data by type of vehicle—car, truck, bus, etc; location, time, and duration of peak loads.

b. Highway tunnels.

(1) *Location and identification.*

- (a) Route name, number, and section.
- (b) Name, number, or other identification.
- (c) Coordinates and distance in miles or kilometers from an easily identified reference point.
- (d) Nearest town identifiable on a map.
- (e) Map and photographic references.

(2) *Characteristics.*

- (a) Roadway surface type, condition, and traffic lanes.
- (b) Truck traffic clearances, including usable roadway width, minimum vertical clearance, minimum radius of curvature, and maximum roadway gradient when warranted.
- (c) Volume of traffic by type.
- (d) Details of repair, storage, or parking facilities within tunnel or vicinity.
- (e) Detours available and distances involved.
- (f) Map, photographic, and basic document references including design specifications, clearance or cross-sectional diagrams showing overall dimensions and minimum clearances for truck traffic.

c. Highway Fords.

(1) *Location and identification.*

(2) *Characteristics.*

- (a) Alinement, gradient, and condition of banks and approaches.
- (b) Length of ford or width of streambed.
- (c) Roadway surface type, usable width, traffic lanes, and conditions.
- (d) Depth of water and velocity of current at different seasons when usable. (Good fords have less than 2-foot water depths and a current less than 3 miles per hour.)
- (e) Limiting factors (load and speed restrictions, etc.), normal crossing time, and periods unusable.
- (f) Detours and alternate crossing sites, including evaluation of streambed above and below the ford.
- (g) Map and photographic references, plans, charts, and diagrams.

d. *Ferries and Ferry Facilities.*

(1) *Location and identification.*

(2) *Route details.*

- (a) Name of terminals and water distances between them.
- (b) Possible alternate routes or crossing points.

(3) *Characteristics and inventory.*

- (a) Name, age, and condition of ferries in service, including statement of capacities in short tons and in number of passengers and vehicles, by sizes, that can be accommodated.
- (b) Technical details of ferry including length, beam, and draft; motive power and horsepower for each unit; fuel type, capacity, and source; and method of unloading (side or end).
- (c) Number, type, and efficiency of operating personnel.
- (d) Largest and heaviest vehicles or loads handled and techniques employed.

(4) *Traffic statistics.*

- (a) Crossing time (light and loaded) and roundtrip crossing time including loading, unloading, and docking time.
- (b) Periods not operational and causes.

(5) *Terminal facilities.*

- (a) Operating capacity and limiting factors, including references to handling, storage, fueling, repair, main-

tenance and loading or clearance facilities, and equipment and personnel.

(b) Potentialities for military transportation use.

e. *Equipment and Facilities for Crossing Streams and Rivers.*

(1) *Floating equipment.*

(a) *Individual.* Individual equipment is that worn or used by individuals to provide buoyancy and propulsion. Information should include—

1. Physical characteristics: shape, size, material, weight, dimensions.
2. Type of propulsion: oars, flippers on feet, paddles, small motors.
3. Means provided to prevent equipment from filling with water (air, cork).
4. Quantity of equipment and trained personnel available.

(b) *Floating bridges.* Information should include: Load capacity, width, length, type of roadway, maximum speed and vehicle spacing.

(2) *Fixed facilities.*

(a) *Bridges.*

1. *Types and characteristics.* There are many types of bridges, but those most commonly found are stringer, girder, suspension, and truss (fig. 4). The main characteristics of these bridges are described below.

(a) *Stringer.* This type consists of two main parts—substructure and superstructure. The substructure is built of end supports, called abutments, and intermediate supports, called bents or piers. The superstructure consists of stringers (longitudinal members spanning the distance between intermediate supports or abutments) and the flooring.

(b) *Girder.* A girder bridge is one on which the roadway loads are transmitted from the floor system to the abutments, or piers, by steel or iron girders. Girders are of two basic types—plate and truss. A plate girder has a solid web. It may consist of an I-beam or may be built of plates, angles, and channels. A truss girder has an open structural framework composed of angles, bars, and channels.

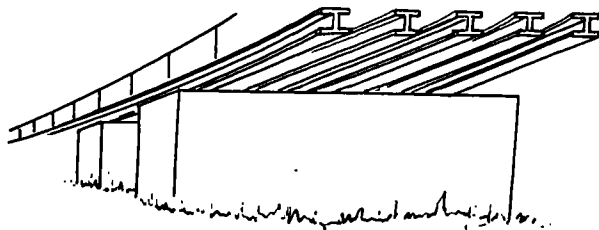
(c) *Suspension.* A suspension bridge has the roadway suspended from two cables that are passed over

the tops of two towers and secured to anchorages on each bank. The floor beams are supported by vertical cables, called slings, suspended from the main cables. The stringers rest on the floor beams.

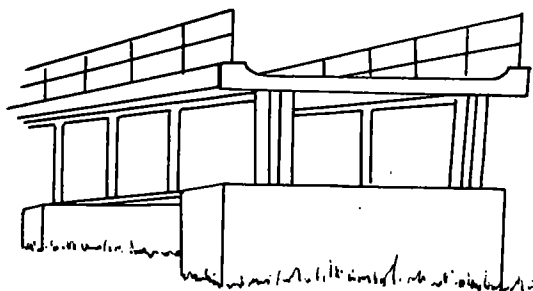
- (d) *Truss*. This type of bridge is used for long spans where a suspension bridge is not feasible. The truss is a compound beam in which the parts are arranged to form one or more triangles in the same plane. Roadway loads are transmitted from the bridge flooring to the abutments and intermediate supports.

2. *Collecting and reporting information*. Information on bridges should include—

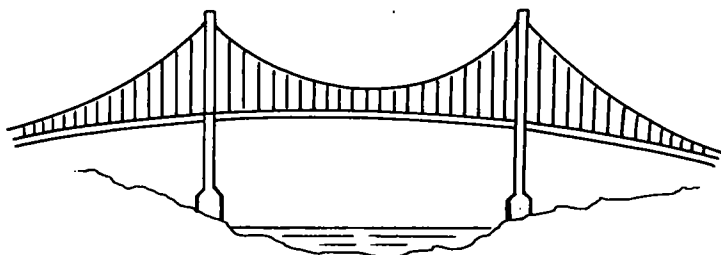
- (a) Location and structural type; name of stream spanned.
- (b) Class (FM 5-36 and TM 5-260); use—vehicular or footbridge.
- (c) Number of lanes and widths of each; separate walkway.
- (d) Spans: number, length, length of panels, anchoring methods.
- (e) Abutments: type, material, dimensions.
- (f) Intermediate supports: type, material, number, location, spacing, sizes and placement of members.
- (g) Stringers: number per span, type, material, size, spacing.
- (h) Flooring: type, material, roadway clearance, thickness, number of layers (for plank floor), and thickness and direction of each layer.
- (i) Physical condition of the structure and apparatus—including condition of welding, rivets, bolts.
- (j) Approaches.
- (k) Vulnerability of bridge to damage by flood or ice, including possible flanking of abutments by erosion.
- (l) Type of soil in stream or gap and around abutments.
- (m) Safety and security features.
- (n) Bypass conditions.
- (o) What is needed for major repairs or improvements.
- (p) Drawbridges: type and dimensions; clearance width(s), allowing for fenders and for navigation of passageway; clearance height of lift spans



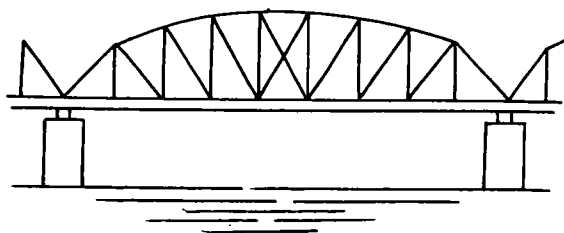
STEEL STRINGER



GIRDER



SUSPENSION



TRUSS

Figure 4. Common types of bridges.

when raised (specify stage of river); details of operating machinery; practicability of hand operation, including time required to open and close; time required to open and close by machinery; how frequently the span is normally opened; how frequently it would have to be opened to handle water traffic deemed essential under theater policies; availability of trained and trustworthy operators.

- (b) *Cableways.* A cableway is used to cross obstacles if other methods are impractical because of high banks, swiftness of current, or conditions which may be encountered in mountainous terrain. A cableway consists of a track suspended between two towers and anchored behind each tower. The traveling carriage, which is the load carrier, is suspended from the track cable and is usually drawn back and forth across the span by a cable attached to a power unit. Information should include anchoring equipment for the main cables, capacity of carriage, speed with maximum load, and type of drive and hoist units provided.

f. Traffic Bottlenecks. Information about traffic bottlenecks and potential areas of congestion should include facts about—

- (1) Highway and road tunnels.
- (2) Narrow roads and streets, including those which can only handle one-way traffic.
- (3) Sharp curves and switchbacks.
- (4) Steep grades and long grades, including poor-traction areas.
- (5) Overpasses and underpasses.
- (6) Fords and ferries.
- (7) Minimum clearances.
- (8) Detours available.
- (9) Flood conditions and other conditions related to weather.
- (10) Defiles.
- (11) Narrow bridges and weak bridges.

g. Terrain. Terrain is of primary importance when evaluating the enemy's ability to effectively move persons and things by motor transportation. When obtaining information, consideration should be given to—

- (1) Concealment and cover available from vegetation or other terrain features, including covered routes of communications.

- (2) Natural and artificial obstacles.
- (3) Topography and hydrography.
- (4) Drainage and relief.
- (5) Surface materials and surface conditions of roads and bivouac areas.
- (6) Effect of weather on surface, such as flooding and freezing.
- (7) Cross-country trafficability.
- (8) Landing and drop zones available.
- (9) Geology and hydrology of the area.
- (10) Location, size, and characteristics of urban areas.
- (11) Characteristics of beaches and other landing areas where motor transport will operate.

3. Information Sources

Information needed for producing highway intelligence data and for highway transportation planning can be obtained from the following documents and agencies.

a. Documents. Valuable information can be obtained from the documents discussed below. Copies of these documents should be sent to the U.S. Army Transportation Intelligence Agency, Washington 25, D. C., and when required, the intelligence element of transportation sections at other echelons of command.

- (1) *Highway maps.* Highway maps, town plans, and atlases contain information concerning route location, alignment, width and mileages, type of road and surface, traffic lanes, interconnections, principal towns, terrain features, and other data. Usually maps can be obtained from public works departments or commercial agencies.
- (2) *Route logs.* Detailed route descriptions, by mile or kilometer post locations, which provide data concerning type, width, and characteristics of highway or street surface, base, and shoulders; bridges, tunnels, fords, and ferries; bottlenecks of all types; overhead clearances; radius of curves; gradients; sight distances; repair and servicing facilities; and similar data.
- (3) *Traffic surveys.* Studies of traffic patterns: an analysis of traffic characteristics, variations in traffic flow, and the classification of highway traffic by types of vehicles. Data should provide basic information about the number of vehicles that travel a highway, vehicle sizes and speeds, truck weights and capacities, frequency of maximum loads, and recurring high-volume traffic.

- (4) *Traffic flow chart.* This is a chart that shows the average traffic movement over various routes during a given period of time. These traffic movements are drawn to scale by using lines of varying widths. The average daily number of vehicles carried by individual routes is shown. The figures are usually based on one-day, periodic, continuing, or seasonal traffic counts at various locations in rural and urban areas.
- (5) *Traffic studies.* These include truck weight studies which show truck distribution by types, average loaded weight of trucks by types, trends in vehicle weights and speeds, routes used, and correlation of this information with pavement performance data.
- (6) *Traffic laws and regulations.* Traffic rules and regulations are often published in booklet or pamphlet form. These publications contain: illustrations and explanations of traffic control signs and signals, pavement markings, turning controls, curb-parking controls, traffic routing (one-way street systems, truck and bypass routes), extent of standardization, and accident rates.
- (7) *Classification plan.* This plan designates roads and streets that have similar characteristics and perform similar functions as separate systems—for example, federal, state, and local. These distinct systems may be assigned to different governmental agencies for administration. Mileages, volume, and percent of traffic by road or street class may be indicated.
- (8) *Engineering texts, booklets, pamphlets, and government publications.* These publications contain information concerning national or regional standards for surface and base materials, widths, and thicknesses; shoulder widths; passing-sight distances; intersections; radius and superelevation of curves; percent of grades; overhead clearances; speeds; bridge ratings; control of access; axleloads; capacities (ability to accommodate traffic); and similar essential transport operations data.
- (9) *Manufacturers' publications.* These publications contain information concerning regional and national standards for dimensions, weights, speeds, and axle and wheel loadings of vehicles.
- (10) *Vehicle inventories.* Inventories should show available operating equipment, giving total number of vehicles by types and details about size, body type, cargo-carrying

capacity, fuels used, performance characteristics, operating condition, use, and other data.

- (11) *Operating schedules and statistics.* This type of information includes: passenger, bus, and truck transport schedules; general operating rules and regulations; routes of movements; data concerning operating personnel, facilities, and equipment; transport operations statistics, including number of passengers and ton-miles of freight hauled during given periods.
- (12) *Construction plans and progress reports.* These are reports on overall highway improvement, including projects planned, completed, or underway; plan and elevation drawings of principal roadway structures; and diagrams showing typical cross-sectional views of the roadway.
- (13) *Aerial and ground photographs.* Photographs are essential. Particularly valuable are closeup views of typical highway features depicting roadway surface and widths, bottlenecks of all types (sharp curves, steep grades, narrow bridges, fords, underpasses), and principal structures (par. 27c).
- (14) *Special equipment inventories.* Inventories of construction equipment should include type and make, details about size, capacity, fuels, performance characteristics, etc.
- (15) *Design and specification standards.* Design and specification standards for roads, highways, and tunnels are usually published by the ministry of public works or the ministry of transportation. Additional information may be found in technical and engineering publications and textbooks.
- (16) *Organizational charts.* These charts show the organizational structure of the ministry or agency in control of the highway network.

b. Agencies.

- (1) Public works office.
- (2) Highway resident and field offices, and transport control organizations.
- (3) Road maintenance crews.
- (4) Ministry of transportation or its equivalent.
- (5) Truckers associations.
- (6) Trucking and transit firms.
- (7) Tourist bureaus.
- (8) Major oil companies.

- (9) Bookstores and libraries (for yearbooks, maps, travel folders, transportation statistics, etc.).
- (10) Civil transportation and engineer planning and operating units.
- (11) Road associations—usually affiliated with the International Road Federation.
- (12) Traffic control authorities, including local or national police forces—often under the ministry of interior.
- (13) Vehicle manufacturers.

4. Estimating Highway Capability

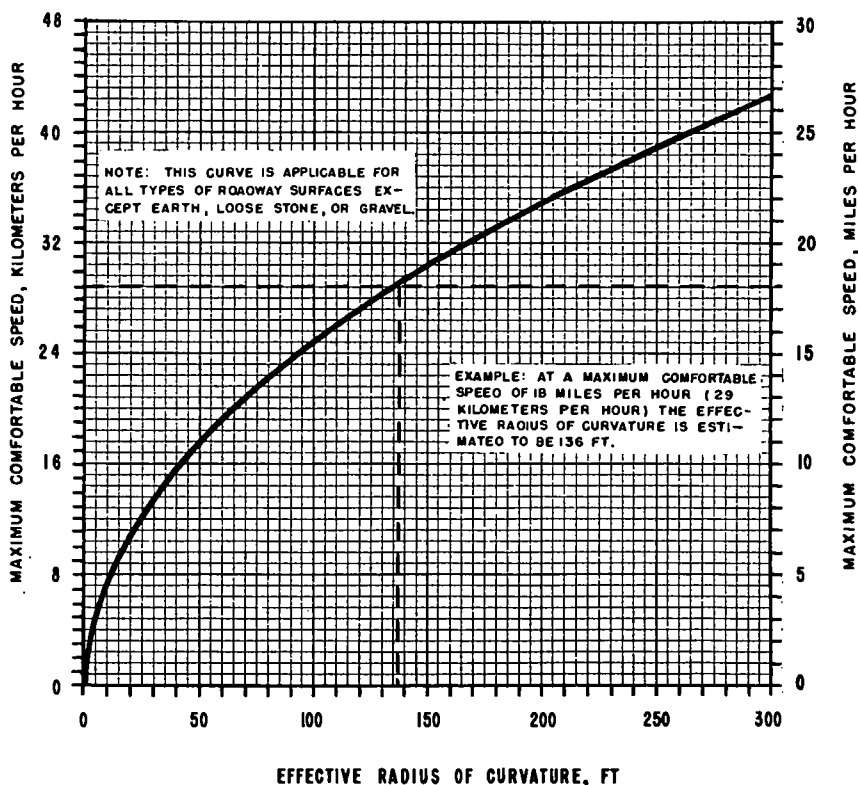
a. General. The capability of a highway to support either a normal or a maximum vehicular movement is determined by a number of factors: surface type, width of surface and shoulders, curves and gradients, moisture, number of traffic lanes and operational factors. No one highway movement is apt to be affected by all these basic factors. Conditions dictate the factors which must be used when estimating a highway's capability. FM 55-54 provides comprehensive guidance on how to estimate highway capability for movement of all types of military vehicles. A less comprehensive but workable method for determining the capability of a highway is explained in *b* and *c* below. This method is based on the assumption that the highway bridges are adequate, or will be improved, to carry the estimated capabilities.

b. Basic Factors.

- (1) *Surface type.* Roads are grouped into types, each type having a basic maximum capacity. The various types of road surfaces with their basic and operational capacities are shown in table I.
- (2) *Surface and shoulder width.* For a two-way movement, the ideal highway is 24 feet wide and has shoulders at least 7 feet wide. The shoulder factor should not be ignored, but it should be considered only as a means of maintaining maximum capacity rather than as a means of increasing capacity. If there are no shoulders or if they are less than 7 feet wide, a reduction factor should be used. Table II gives surface and shoulder width factors.
- (3) *Curve and gradient (fig. 5).* Curves and gradients affect the capacity of roads. Curve and gradient factors applicable to undulating, hilly, and mountainous areas are shown in table III. Radius of curvature is measured

from the center of the circle to the middle of the road. Gradient, or slope percentage, is the ratio of the vertical rise to the horizontal distance traveled.

- (4) *Moisture.* Moisture has an important bearing on the capacity of road surfaces to withstand sustained vehicular movement. Heavy concentrations of or long exposure to moisture affects the subsoil of even the highest type pavement. Both the surface and subsoil of low type or unimproved roads are immediately affected. The degree of moisture can be determined by studying data on soil



MAXIMUM COMFORTABLE SPEED: SPEED AT WHICH CENTRIFUGAL FORCE INITIALLY CAUSES THE DRIVER OR PASSENGER TO FEEL AN UNCOMFORTABLE SIDE PITCH OUTWARD.

EFFECTIVE RADIUS OF CURVATURE: RADIUS OF AN EQUIVALENT HORIZONTAL CURVE HAVING NO SUPERELEVATION (BANKING).

Figure 5. Estimating highway curve radius.

conditions and on seasonal variations in weather. Tables IV and V may be used as guides in determining the effect of moisture on the capacity of a highway to withstand sustained and maximum vehicular movement. Reports of good, fair, and poor surface conditions have to be evaluated by the analyst. He must compare them with other reports, photographs, and information about the road network.

(5) *Number of traffic lanes.*

- (a) *One lane.* Roads less than 18 feet wide can be used only for one-way movement; therefore, the whole adjusted sustained capacity is in one direction. To maintain this type of movement over a period of time, alternate routes for return of empties must be available or the hours of operation must be reduced to allow for the return of empty trucks. The one-way factors shown in table II are sufficiently small to reduce capacities from two lanes to one lane.
- (b) *Two lanes.* Roads over 18 feet in width can support one-way or two-way movement. Since the capacities shown in table I are for all traffic, the adjusted capacity will be in terms of total traffic moving in both directions for two-way movement. Half of this total two-way movement therefore represents the highway capacity in one direction.
- (c) *Multilane.* A multilane, divided highway of a given width can support a greater volume of traffic than an undivided highway of the same width because all traffic on any one lane is moving in the same direction. Since total traffic may move in one or both directions, the adjusted capacity may be determined in the manner described in (b) above. The greater capacity of multilane systems is allowed for in table II.

(6) *Operational.*

- (a) *Turning and cross movements.* Although the turning and cross movement factor varies between 1.0 and 0.5, according to the size and nature of the overall operation, the average factor of 0.85 may be used when estimating highway capacity.
- (b) *Hours of running time.* Running time may be determined by the hours of daylight or darkness. The running time selected should in no case exceed 18 hours a day for a sustained movement. When planning a

one-way movement over a route for which no alternate is available, the running time selected must include time for returning empties and for turning around.

- (c) *Weather and other factors.* Certain operational factors, such as the weather and the tactical situation, cannot be accurately assessed beforehand.

Table I. Highway Daily Capacity: Basic and Operational

Vehicle type	Surface type	Average speed (mph)	Vehicle interval (ft)	Capacity in vehicles per 24-hours for all traffic ¹	
				Basic	Operational ²
3-ton cargo truck	Cement concrete, bituminous concrete, intermediate bituminous, and bituminous surface treated	25	300	21,100	16,900
	Waterbound macadam, gravel, and crushed stone	20	600	8,400	6,700
	Improved earth	20	800	6,300	5,000
	Unimproved earth	10	1,000	2,500	2,000

¹ Capacities are based upon assumptions that drainage and thickness of base are adequate.

² Operational capacity is approximately 80 percent of basic capacity.

Table II. Surface and Shoulder Width Factors

Type of movement	Number of lanes	Surface			Shoulder		
		Width (ft)	Factor		Width (ft)	Factor	
			Divided highway	Undivided highway		Divided highway	Undivided highway
One-way	1	8-11	-----	0.5	0-2	-----	0.8
	-----	-----	-----	-----	2-7	-----	0.9
Two-way	1	12-17	-----	0.6	7-12	-----	1.0
	2	18-20	-----	0.8	0-2	-----	0.8
	2 or 3	21-23	-----	0.9	2-7	-----	0.9
	2 or 3	24	-----	1.0	7-12	-----	1.0
	4	36	2.0	1.8	0-2	0.8	0.8
	4	42	2.2	2.0	2-7	0.9	0.9
	4	48	2.5	2.2	7-12	1.0	1.0

Table III. Curve and Gradient Factors

Terrain	Curve, minimum radius (ft)	Gradient		
		Percent	Horizontal-vertical ratio	Factor
Undulating	150	3 to 5	33-1 to 20-1	0.9
Hilly	100	Over 5 to 7	Steeper than 20-1 to 14-1	0.8
Mountainous	50	Over 7	Steeper than 14-1	0.6

Table IV. Factors Used to Determine Effect of Moisture on Highway Capacity

Surface type	Condition of road								
	Good			Fair			Poor		
	Dry	Moist	Wet	Dry	Moist	Wet	Dry	Moist	Wet
Cement concrete, bituminous concrete	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	0.7
Intermediate bituminous	0.9	1.0	0.8	0.9	0.9	0.6	0.8	0.9	0.4
Bituminous surface treatment	0.6	0.7	0.3	0.6	0.7	0.2	0.3	0.4	0.1
Waterbound macadam, gravel, crushed stone	0.4	0.6	0.2	0.3	0.5	0.1	0.2	0.4	0.05
Improved earth	0.3	0.6	0.2	0.3	0.5	0.1	0.2	0.4	
Unimproved earth	0.3	0.6	0.2	0.3	0.5	0.1	0.2	0.3	

Table V. Number of Days Surfaces Can Support a Maximum Movement

Surface type	Condition of road								
	Good			Fair			Poor		
	Dry	Moist	Wet	Dry	Moist	Wet	Dry	Moist	Wet
Cement concrete, bituminous concrete	30	30	30	30	30	30	20	20	20
Intermediate bituminous	15	15	15	15	15	15	10	10	5
Bituminous surface treatment	10	10	5	10	10	5	5	5	1
Waterbound macadam, gravel, crushed stone	5	5	1	5	5	0.5	2	2	0-0.25
Improved earth	5	5	0.5	5	5	0-0.25	2	2	
Unimproved earth	5	5	0.5	2	2	0-0.25	0-0.25	0-0.25	

c. *Making the Estimate.*

(1) *General.* No one highway or movement is apt to be affected by all the basic factors described in *b* above. Conditions dictate the factors which must be used when estimating a highway's capacity. The analyst must consider each problem separately. In some situations a factor of 1.0 will apply: in such cases the operational capacity is not affected. Methods and examples of estimating highway capacity to support normal and maximum movements are given below.

(2) *Methods.*

(a) *Normal movement.* To make a highway capability estimate, determine surface type and multiply the operational capacity in number of trucks (table I) successively by each of the following factors that is applicable: width of surface and shoulder, curve and gradient, moisture. The figure thus obtained will be for a 24-hour day; adjust this figure to reflect the actual working hours in the day by multiplying it by the following fraction:

$$\frac{\text{Working hours in day}}{24}$$

Adjust the figure further to show movement in one direction only by dividing by 2 if a two-way movement. If movement is one-way, no further reduction is necessary since surface width factor provides for one-way movement. Convert to tonnage capability.

(b) *Maximum movement.* To estimate the capability of a highway to support a maximum movement, multiply the basic daily capacity successively by the surface and shoulder width factors, the curve and gradient factor, and the turning and cross movement factor. Although the moisture factor is not used as a multiplier in making a maximum movement estimate, the number of days the highway can support a maximum movement under varying degrees of moisture must be considered. Adjustments of the figure thus obtained are made in the same manner as for the normal movement described in (a) above except that the working day is 20 hours. Owing to the influence of the surface on such movements when no road maintenance is performed, high type surfaces can sustain movements for longer periods than low type surfaces (table V).

(3) *Examples.*

(a) *Bituminous surface treatment.*

1. *Problem.* What is the sustained capability of a bituminous surface treated highway where—

Surface is 12 to 20 feet wide and in fair condition

Shoulder width is 6 to 7 feet

Maximum gradient is 10 percent

Minimum curve radius is 100 feet

It is the dry season

Alternate routes are available for the return of empty trucks

Operations will be 12 hours per day

Three-ton cargo trucks will be used.

2. *Solution.* The operational capacity for 3-ton cargo vehicles on bituminous surface treatment is 16,900 vehicles per day (table I). Inasmuch as surface widths vary from 12 to 20 feet, the estimate must be for a one-way movement. The returning empty trucks will use alternate routes. The surface width factor (table II) is 0.6 for a 12-foot surface; the shoulder factor is 0.9. The curve and gradient factor for 10 percent grades is 0.6 (table III). The moisture factor is 0.6 for bituminous surface treatment in dry weather and fair condition (table IV). The average factor for turning and cross movement is 0.85. Therefore the calculation for this estimate is $16,900 \times 0.6 \times 0.9 \times 0.6 \times 0.6 \times 0.85$ or 2,793 vehicles per day. Multiplying the number of vehicles by 3 (the average payload in short tons carried by each vehicle) gives a highway capability of 8,379 short tons per 24-hour day for a sustained period. Since the operation is only for 12 hours per day, the net capability is one half of 8,379 or 4,190 short tons per day. It should be noted that this problem involves a 12-hour, one-direction movement because alternate routes are available for the returning empties. Had no alternate routes been available, the running time, which must include time for changing direction and returning empties, might have been 8 hours forward, 8 hours returning, and 2 hours for transition. This makes a total of 18 hours per day, which is the recommended maximum for sustained movement.

(b) *Gravel surface.*

1. *Problem.* What is the sustained capability of a gravel-surfaced road where—

Surface is 18 feet wide and in poor condition

Shoulder width is 2 feet

Maximum gradient is 10 percent

Minimum curve radius is 200 feet

It is the wet season

No alternate routes are available

Operations are for 14 hours per day

Three-ton cargo trucks will be used.

2. *Solution.* The operational capacity of a gravel surface to support 3-ton cargo trucks is 6,700 vehicles per day (table I). A two-way movement is planned because the surface is 18 feet wide and no alternate routes are available. According to table II, the surface width factor is 0.8; the shoulder width factor is also 0.8. The curve and gradient factor is 0.6 (table III). Table IV shows the moisture factor to be 0.05 for a wet gravel road in poor condition. The factor of 0.85 is used for turning and cross movement. The calculation for this estimate is $6,700 \times 0.8 \times 0.8 \times 0.6 \times 0.05 \times 0.85$ or 110 vehicles per day with vehicles traveling in both directions. Therefore 110 divided by 2 will give 55 vehicles for a one-direction movement. Then 55 times 3 (average number of tons carried by each vehicle) equals a capability of 165 short tons per 24-hour day. Using a 14-hour working day, the net capability is fourteen twenty-fourths of 165 or 96 short tons per day for sustained operations.

(c) *Four-lane, divided highway.*

1. *Problem.* What is the sustained capability of a four-lane, divided highway where—

Surface is cement concrete in fair condition

Width of each two-lane section is 24 feet

Shoulders are 7-feet wide

Maximum gradient is 4 percent

Minimum curve radius is 1,000 feet

The weather is dry

Operations will be for 12 hours per day

Three-ton cargo trucks will be used.

2. *Solution.* Use the operational capacity of 16,900 vehicles per day for a cement concrete surface as the

basic figure for the computation (table I). The surface width factor for a 4-lane, divided highway with two 24-foot surfaces is 2.5 and the shoulder width factor is 1.0 (table II). The curve and gradient factor (table III) is 0.9 for 4 percent grades. The moisture factor for fair cement concrete in dry weather is 1.0 (table IV). The average factor for turning and cross movement is 0.85. Thus the calculation for sustained movements on this section of highway is: $16,900 \times 2.5 \times 1.0 \times 0.9 \times 1.0 \times 0.85$ or 32,321 vehicles. This figure represents the number of vehicles per 24-hour day that is the practical total capacity of the highway. Since returning empty trucks will use the highway also, the cargo movement forward will be one half of the capacity. Therefore the traffic in one direction will be 16,160 vehicles per day. Because operations are for only 12 hours per day, 16,160 must be divided by 2 which gives a net capacity in one direction of 8,080 vehicles per day. The sustained capability in tonnage will be $8,080 \times 3$ or 24,240 short tons per day.

(d) *Maximum movement over four-lane, divided highway.*

1. *Problem.* What is the maximum movement capability of the four-lane, divided highway described in (c) above?
2. *Solution.* Procedure is the same as that outlined in (c) above except basic capacity is used instead of operational capacity (table I), the moisture factor is not considered, and running time is increased to 20 hours per day. The computation is $21,000 \times 2.5 \times 1.0 \times 0.9 \times 0.85$ or 40,353 vehicles per 24-hour day traveling in both directions. Since operations are for 20 hours per day and only forward traffic is desired, 40,353 times twenty-fourths divided by 2 would give 16,813 vehicles per day forward. The net short term tonnage capability is then $16,813 \times 3$ or 50,439 short tons per day. This capability for cement concrete in fair condition could be maintained on a maximum basis for 30 days (table V).

APPENDIX V

PORT, BEACH, AND LANDING AREA INFORMATION REQUIREMENTS

1. Areawide Information

Information requirements of a general nature about an area should include facts about the topics outlined below.

a. Importance of Ports, Harbors, Beaches, and Landing Areas.

- (1) Place of water terminal facilities in the national economy, including relationship to industry, agriculture, and other components of the transportation network.
- (2) History of water terminal development and influencing factors.
- (3) Adequacy of water terminal facilities for country's peacetime and wartime transportation needs; potentialities for major improvement or development for military purposes.

b. Description and Analysis of the Water Terminal Facilities Complex.

- (1) Small scale annotated maps, charts, and diagrams indicating the location of ports, harbors, beaches, and landing areas; critical features of anchorage areas, channels, breakwaters, and vessel berths; heavy lift, storage, servicing, repair, and clearance facilities; and mileages between all important locations.
- (2) Discussion of official construction standards for water terminal facilities and the extent observed. Location, organization, and scope of activities or agencies in charge of construction and maintenance.
- (3) Details of the status and scheduling of current projects and proposed plans for the development, improvement, or standardization of water terminal facilities.
- (4) Summary analysis of the operating condition, limitations, capacity, and military potentialities of ports, harbors, beaches, and landing areas in the country.
- (5) Details of the organization, training, operations, and capabilities of water terminal operating units in the military service, including tables of organization and

equipment, field and technical manuals, and related training literature.

- (6) Explanation of local terms used in describing ports, harbors, beaches, landing areas, and related transportation activities and facilities.

c. Organization and Administration of Water Terminal Facilities.

- (1) Ownership, funding, governmental regulatory controls; nature and extent of foreign influence and interests.
- (2) Location, organization, and functions of agencies responsible for control and administration of water terminal activities at national, regional, and local levels.
- (3) Number of water terminal administrative personnel by departments and divisions and their training, education, technical qualifications, and efficiency.
- (4) Size and quality of the skilled and unskilled labor force, centers where recruited, training and experience, working conditions, wage scales, attitudes toward Americans, and dissident and sympathetic elements.
- (5) Financial statistics, shipping and stevedoring rates, operating revenues and expenses, and foreign financial aid received for water terminal development.

d. Water Terminal Operations Data.

- (1) Operating regulations, methods, and standards for freight and passenger traffic; methods of documentation and containerization.
- (2) Operating statistics tabulated and analyzed for each port and for the water terminal complex as a whole, including—
 - (a) Methods of and special regulations affecting cargo handling and transfer.
 - (b) Average cargo handling rates by types of cargo (inbound and outbound), annually, monthly, daily, and hourly.
 - (c) Average daily tonnages of cargo worked alongside and by lighter.
 - (d) Average turnaround time for cargo vessels and tankers.
 - (e) Total net register tonnage and number of vessels, by size, type, and draft calling at the country's ports yearly.
 - (f) Maximum permissible length, draft, beam, and load for vessels using the ports and landing areas; length and draft of largest ship regularly visiting the port.

- (g) Average daily tonnages, by commodities, handled at principal loading, unloading, and transfer points within particular port areas.
- (h) Maximum number of vessels by type, size, and draft that can be berthed and worked simultaneously at alongside berths and in the stream. Estimated future traffic increases.
- (i) Estimate by military planners, port authority, or other competent source of the maximum daily cargo tonnage that can be unloaded from ships and cleared from the port area daily by rail, highway, air, inland waterway, and pipeline. Factors that can be used in developing the estimate are: number, size, and draft of vessels being worked simultaneously at alongside berths and in the stream; number, capacity, and speed of lighters available; length of working day; methods of cargo transfer (by cranes or ships' gear); and type of cargo handled.
- (j) Estimate of maximum daily tonnage that can be out-loaded.

e. Water Terminal Operations Research and Development (Civil and Military).

- (1) Research and development policy, funding, objectives, and capabilities.
- (2) Testing and development centers, facilities, equipment, and key personnel.
- (3) Current water terminal research and development projects and progress.

2. Detailed Description of Individual Ports, Harbors, Beaches, and Landing Areas

a. Identification. Give name, location, and characteristics. Identification should state whether an open roadstead, partly inclosed bay, landlocked harbor, sheltered area behind barrier reef, estuary, river, canal, or lake.

b. Description.

- (1) *Approaches and entrances.* Usual method of approach and alternate means; natural protection, breakwaters, jetties; entrance channel length, controlling width and depth; maximum length, beam, and draft of largest vessel which can enter; extent of dredging required; navigational hazards and necessity for pilotage; outer bar if any (location, width, depth, tendency to shift and shoal); inner channel characteristics; equipment locally available

for channel maintenance and improvement; and ice conditions.

- (2) *Tides and tidal currents.* Tidal rise and range including heights of high and low water, springs and neaps; and rate and direction of tidal streams and currents.
- (3) *Weather.* Description of weather conditions that might affect cargo loading and discharge activities.
- (4) *Anchorage.* Details of all anchorages or potential anchorages; depths of water; approach channels; shelter afforded; wind, wave, and current conditions; type of bottom and holding ground; mooring installations; and number and type of vessel berths.
- (5) *Harbor.* Description of locks, bridges, mooring buoys, ferry services, power stations, breakwaters, wet docks, and semitidal basins; location in relation to town or coast; general form and type; framework and component parts; aids to navigation; pilotage; shores adjoining harbor.
- (6) *Beaches and landing areas.* Because of the importance of beaches and landing areas in amphibious operations, detailed information is needed about—
 - (a) *Hydrographic conditions (fig. 6).*
 1. *Depth of water along shore.* Depth of water from a predetermined seaward limit to the beach.
 2. *Sea bottom.* The nature, profile, and consistency of the sea bottom from the predetermined seaward limit to the beach at lowest low water, including whether it is sand, shell, shingle, rock, mud, gravel, coral, silt, etc.
 3. *Surf.* The distance from shore that the line of breakers forms, average height of breakers from crest to trough, type and number of lines of breakers, including period, width of the surf zone, and angle at which the surf strikes the shore.
 4. *Currents.* The location, type, direction, and speed of offshore and inshore currents, including dangerous sea conditions, such as rips and undertows.
 5. *Tide.* The tidal range and period, including the duration and variation of high and low water and the effect of tide upon beach width.
 - (b) *Offshore natural obstacles.*
 1. *Reefs.* The width; length; slope; height above or depth below water at various tidal stages; nature of reef surface; effect of reef on surf and tide conditions;

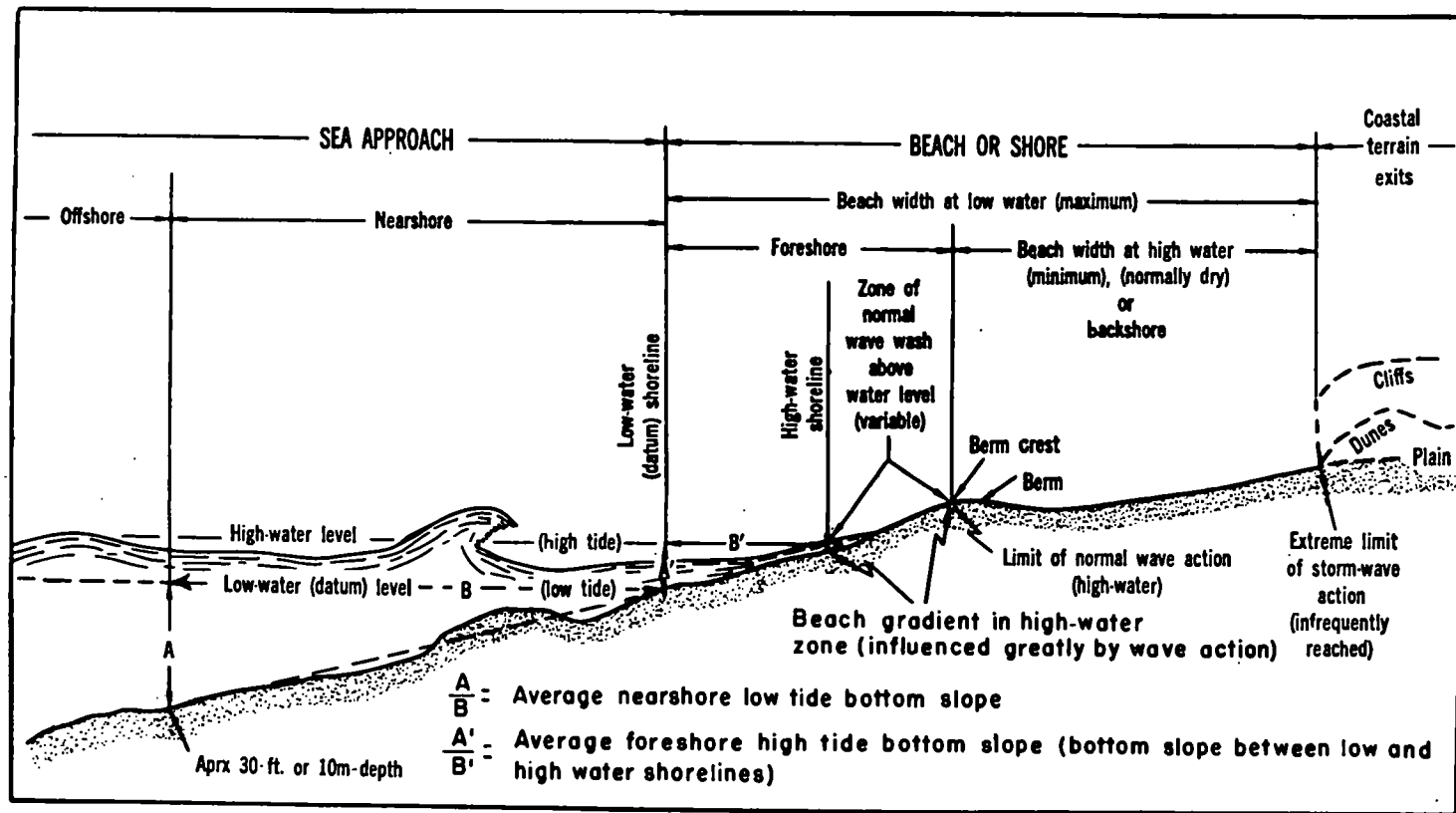


Figure 6 Beach profile diagram.

presence of boat channels, including location, depth, width, and capability of improvement; distance offshore of barrier reefs; and depth, nature of bottom, and landward slope of lagoons.

2. *Sandbars*. Distance offshore, width, length, consistency, slope (both seaward and landward), depth below water at various tidal stages, passages for landing craft, and inshore water, including depth and nature of bottom.
3. *Rocks and shoals*. Location, extent, size, and height above or depth below water at various tidal stages.
4. *Seaweed*. Location, extent, and type (kelp, dulse, rockweed, sea lettuce, etc.).

(c) *Beach description*.

1. *Geographical location*. Geographical coordinates of the beach limits and the bearings and distances from the beach to major topographical manmade features in the general vicinity.
2. *Extent*. Width and length of the beach at mean low and high water; location and extent of runnels, groins, and rock outcroppings which reduce the length or width of the beach.
3. *Composition and consistency*. Composition and consistency of the beach including its texture (fine or coarse); type of material (sand, gravel, mud, etc.); practicability of traversing by troops and vehicles, both tracked and wheeled; effect of the tide on the surface (whether beach becomes hard and packed at low water); and the degree of solidity offered by any vegetation growing on the beach.
4. *Gradient*. The low-water to high-water gradient and the high-water-zone gradient.
5. *Natural obstacles*. Location, type, and extent of all natural obstacles—such as marshes, swamps, cliffs, dense brush, water areas, berm line, dune line, escarpments, etc.
6. *Routes of egress*. Location, size, condition, and capability of improvement of all beach exits.
7. *Dispersal and storage areas*. Location, size, and description of areas of the beach that can be used for dispersal and storage of equipment and supplies.
8. *Inland limit*. Configuration and nature of the ground at the inland limit of the beach.

(d) *Inland and adjacent terrain*.

1. *Critical terrain features*. Commanding terrain, in-

land or to the flanks of the beach, which could canalize transportation.

2. *Landmarks visible from seaward.* Bearings and distances to landmarks visible from sea which might serve to identify the landing area.

3. *Natural obstacles.*

(a) Location, type, and extent of marches, swamps, and other water areas.

(b) Width of streams, their depth, velocity, nature of bottom, types of banks, and location of any existing fords.

(c) Type, location, and traversability of dense vegetation.

(e) *Facilities, resources, and defenses.*

1. *Communications.*

(a) Location, width, condition, and surface of roads and trails in the vicinity of the beach.

(b) Dimensions, type of construction, and condition of bridges and underpasses; depth, width, and approaches of nearby fords.

(c) Gage, extent, and condition of railroad tracks.

(d) Number and type of wires on telephone and telegraph lines.

2. *Warehouses.* Location, size, and contents of warehouses and supply dumps close to the beach.

3. *Obstacles.* Location, type, and number of artificial obstacles in water and on the beach—such as mines, booms, barriers, nets, wires, tank traps, seawalls.

4. *Restricted areas.* Location, extent, and type of chemically, radiologically, or biologically contaminated areas.

5. *Small craft.* Location, type, and approximate number of naval craft, such as torpedo boats, which are capable of resisting a landing.

(7) *Wharves.*

(a) *Type.* Fixed or floating.

(b) *Purpose.* General or special cargo, or passenger.

(c) *Structural features.* Materials, deck area, strength of deck, height above high water, superimposed structures, location and width of aprons.

(d) *Cargo-handling machinery.* Types and capacity.

(e) *Railroads.* Those on and leading to the facility.

(f) *Berths.* Number of and classification.

(g) *Lighterage facilities.* Type, number, and characteristics of craft.

- (8) *Mooring berths.*
- (a) *Fixed.* Location, layout, number, type, size, capacity.
 - (b) *Free-swinging.* Location, number, layout, capacity according to the standard classification listed below (minimum dimensions are given).
 - 1. *Class I.* Eight hundred-yard diameter, thirty eight-foot depth. Can accommodate large passenger ship or large naval vessel.
 - 2. *Class II.* Five hundred-yard diameter, thirty-foot depth. Can accommodate standard oceangoing cargo ship (Liberty or Victory).
 - 3. *Class III.* Three hundred-yard diameter, twenty-foot depth. Can accommodate small ships (standard coaster, destroyer, etc.).
- (9) *Port, beach, and landing area clearance facilities.* Characteristics, connections, and capacities of rail, road, air, waterway, and pipeline facilities. Information should include—
- (a) *Rail.* Lines clearing port (for each line—number of tracks, gage, connecting points, distances), rail facilities in port (connecting line to port area from main terminal point), trackage in port area, railroad yards, bridges and ferries forming integral part of port rail network.
 - (b) *Road.* Roads and highways clearing port: major routes clearing port, connecting points, types of construction, width, condition; streets and roadways in town and port area and adequacy for port operation requirements.
 - (c) *Inland waterway.* Type, connecting points, controlling dimensions, number and type of craft in service for each route clearing port.
 - (d) *Air.* Airfields and airfield facilities in vicinity of port, beach, or landing area; connecting roads; open spaces suitable for improvised landing areas.
 - (e) *Pipelines.* Number, location, commodity carried, size, length, capacity, connecting points, pumping stations, repair facilities, planned construction, type of pipe, permissible pressures. (This information is obtained by coordination with the Quartermaster Corps.)
 - (f) *Miscellaneous.* Data concerning pack and draft animals, human bearers, cableways, and sled trains.
- (10) *Mechanical handling facilities.* Number by type, location, and capacity including cranes, stevedore gear, and

special purpose equipment. Include special handling equipment for liquid fuel, explosives, and perishables.

- (11) *Storage facilities.* Details of storage facilities, including location and capacity of transit sheds, warehouses, cold storage, petroleum storage, bulk storage (grain, coal, ore), and open storage.

(a) *Covered storage.*

1. *Warehouses and transit sheds.* Total space available in port and description of each unit. Location, owner and/or operator, commodities stored, dimensions, type of construction, total capacity, rail and road connections, fire protection system, and materials handling equipment.

2. *Cold storage facilities.* Location, owner and/or operator, commodities stored, type of construction, type of equipment, daily ice capacity, and storage capacity of each facility.

3. *Bulk storage facilities.*

(a) *Liquid.* Total capacity, breakdown by product, general location and arrangement of storage facilities, owner and/or operator of individual facilities.

(b) *Dry.* Total capacity and general location and arrangement of each storage facility for grain, coal, and miscellaneous dry products.

(b) *Open storage.* Availability of sites in waterfront area for storage of general cargo, rail or road access to these sites, and location and size of individual sites.

- (12) *Repair facilities.* Characteristics and capabilities of dry-docking and ship repair facilities, including repair shops, drydocks (floating and graving), marine railways, fitting-out and repair berths, and miscellaneous repair yards and facilities. Information should include the sizes of the largest vessel that can be repaired and the largest dry-cargo ship that can be built. The information on individual shipyards should include—

(a) *Facilities.*

1. Shipbuilding installations: ways, docks, sites.

2. Drydocking installation, including marine railways.

3. Fitting-out and repair berths.

4. Shops: scope of activity, equipment, capability.

5. Cranes: number and types available, capacities.

(b) *Operation and production.* Volume and type of construction and repair projects; capability; availability,

- source, and quality of materials used; procurement methods and policies; storage facilities.
- (c) *Fire protection.* Brief description of equipment and facilities, including types of fires that equipment is suited to combat (electrical, oil, wood, etc.). This information is obtained in coordination with the Corps of Engineers.
- (d) *Security.* Brief description of organization and installations; security regulations in force.
- (e) *Personnel.*
 - 1. Management; organization, competence, outstanding personalities.
 - 2. Labor; number, categories, quality.
- (13) *Utilities.* Availability, sources, adequacy, characteristics, and distribution. (This information may be obtained in coordination with the Corps of Engineers.)
 - (a) *Petroleum.* Number and capacity of bunkers, types of fuel and stocks maintained, methods of supply, and extent of facilities. If port has no petroleum barges and the capacity of the largest bunkering berth is less than the capacity of the largest alongside berth in port, give dimensions of largest bunkering berth.
 - (b) *Coal.* Availability of bunkers, quality of fuel and stocks maintained, methods of supply, rates of supply, and extent of facilities.
 - (c) *Water.* Supply of water for ships, methods of supply and extent of facilities, quality of water, type and adequacy of port supply. If port does not have water barges and the capacity of the largest watering berth is less than the capacity of the largest alongside berth, give dimensions of largest watering berth.
 - (d) *Electricity.* Characteristics of service current distributed in port area, adequacy of supply for port operations, source of current, wharf outlets.
- (14) *Watercraft inventory and characteristics.* This information requirement includes the number and characteristics of vessels, boats, landing craft, amphibians, and other floating equipment—such as barges, tugs, and cranes. Significant characteristics (as applicable) are:
 - (a) Type.
 - (b) Destination.
 - (c) Length.
 - (d) Beam.
 - (e) Light displacement: deadweight and gross tonnage.
 - (f) Draft.

- (g) Fuel: type, capacity, consumption.
 - (h) Speed: water, land.
 - (i) Operating range.
 - (j) Crew.
 - (k) Capacity: cargo, passenger, cubic foot (bale, grain, reefer), liquid cargo.
 - (l) Cargo-handling equipment.
 - (m) Number of hatches.
 - (n) Seaworthiness.
- (15) *Port administration.*
- (a) Organization and functions of local control agencies, scope of activities, extent of private ownership and control, outstanding personalities.
 - (b) Official services: quarantine, customs, immigration, police, free port, administration, location of facilities, extent of activities.
 - (c) Local port regulations.
- (16) *Port trade and operations.*
- (a) Number, size, type, and registry of vessels calling at port.
 - (b) Average number of passengers embarking or debarking, monthly or annually.
 - (c) Average quantity of cargo, daily and monthly, handled at port; type of movement, discharge or loading; direction of movement, import, export, domestic. Average cargo-handling rates, hourly and daily; ratio of receipts to shipments; ratio of bulk cargo to general cargo; ratio of cargo worked alongside to cargo worked in stream; average vessel turnaround time; prevailing methods of cargo transfer and regulations affecting them; cargo transferred over wharves from one area of port to another; actual or potential limiting factors.
 - (d) Size, efficiency, and organization of normal stevedore force; adequacy for normal port operations; availability of labor reserve; political orientation.
- (17) *Protection.* Position, shape and alinement, dimensions, and construction of breakwaters and other protective works.
- (18) *Silting and dredging.* Liability to silting and dredging requirements of all navigable fairways and berths.
- (19) *Bridges and structures in harbors and ports.* Type and clearances (vertical and horizontal).
- (20) *Naval installations.* Brief description including repair facilities.

- (21) *Major repairs required.*
- (22) *Safety features.*
- (23) *Vulnerability to nuclear or CBR attack.*

3. Information Sources

a. Documents. The following types of documents are required for port and beach transportation planning and production of intelligence. Documents and data of the types listed below should be sent to U. S. Army Transportation Intelligence Agency, Washington 25, D. C., and when requested, to the intelligence unit of transportation sections at other levels of command.

- (1) *Hydrographic charts.* There are several types of hydrographic charts—pilot, navigational, general sailing, coastal, and harbor. Charts of harbors show water depths, channels, islands, character of bottom, berthing facilities, and aids and hazards to navigation. Navigational charts show the topography of the shore and the salient features which aid navigation and berthing.
- (2) *Port plans.* The port plans are accurate, large scale drawings, or representations, showing: the general overall layout with details on berthing, cargo handling, and storage facilities; beaches; feeder canals and tidal creeks; rail, road, and waterway connections and structures; and the location of important servicing installations and repair facilities.
- (3) *Port publications.* Frequently descriptive brochures are issued by the port authority or the controlling body to publicize the port. Companies operating the various installations at a port also issue folders to attract business. Publications of this type, despite their limitations, may furnish valuable information about a port. In addition, publications of local chambers of commerce and boards of trade may give the advantages of a particular port.
- (4) *Beach area surveys.* These are studies of areas that can be used for over-the-beach operations; they give characteristics of beach area, details of water, obstructions, hazards, and natural protections. These surveys also give the topography of land adjacent to the beach area, showing location and type of adjacent highway and rail facilities available for beach clearance; description of areas between beach and highway and railways, indicating hazards, natural obstacles, and amount and type of clearance required; and size, location, and description

of areas that might be used in temporary storage and/or transfer of cargo.

- (5) *Craft census.* This is an inventory of harbor craft and floating equipment including lighters, tugs, powered vessels, barges, and construction and maintenance craft, such as ice breakers, floating pile drivers, dredges, and draglines.
- (6) *Traffic studies and statistics.* Statistical analyses of port activities are included in both national and local economic surveys, almanacs, and yearbooks. These analyses furnish information on volume offloadings and loadings and provide a key to reception, discharge, storage, and clearance capabilities of the port as well as the number, type, draft, dimensions, and tonnage of vessels using the port during normal and peak traffic periods.
- (7) *Guides to internal navigation.* Shipping registers, ship-
pers' almanacs, national pilots, reports of inland water-
way boards, and guides to internal navigation are types
of documents published in several countries that give
information on—
 - (a) Inland and coastal waterway routes and their char-
acteristics, ports, locks, and limiting factors.
 - (b) Shipping of all types, including inland waterway,
coastal waterway, and ocean shipping.
 - (c) General operating rules, regulations, and procedures.
- (8) *Documentation of freight.* Samples of shipping docu-
ments, bills of lading, rules for marking containers, and
related freight documentation material constitute infor-
mation of intelligence value.
- (9) *Design and construction standards.* Basic standards for
design and construction of port and inland waterway fa-
cilities and equipment may be found in engineering texts,
government publications, and equipment manufacturers'
brochures. Such publications may contain information
concerning national or regional standards for wharf or
quay construction, vessel and cargo handling equipment
characteristics, transit storage facilities, lock construc-
tion, and other marine facilities.
- (10) *Construction plans and progress reports.* These include
overall port and waterway improvement policy and pro-
grams; current and proposed port and waterway im-
provement plans—projects planned, completed, or under
way; and progress reports (dated) on all such projects.

- (11). *Aerial (vertical and oblique) and ground photographs.* Photographs are essential, particularly closeup views of wharves and cargo handling facilities and equipment; road, rail, and waterway clearance facilities and equipment; locks, vessels, transit storage, and vessel repair facilities; floating equipment; vessels being worked alongside and in the stream; beaches and exits; and principal limiting structures.
- (12) Coast and geodetic survey publications similar to the "U. S. Coast Pilot."
- (13) Hydrographic office publications comparable to "Sailing Directions," "Tide Tables," "Current Tables," and "Pilot Charts."

b. Agencies.

- (1) Port authorities.
- (2) Weather and statistical bureaus.
- (3) Chambers of commerce.
- (4) Municipal.
- (5) Ministry of transportation.
- (6) Construction and engineering contractors.
- (7) Commercial steamship lines.
- (8) Military planning and operating sections and units.
- (9) Stevedoring firms.
- (10) Equipment and craft manufacturers.
- (11) Governmental agencies comparable to U.S. Departments of Labor, Commerce, and Interior; Bureau of Internal Revenue; Hydrographic Office; and Maritime Administration.

4. Estimating Water Terminal Discharge Capacity

a. Terminal Discharge Capacity Defined. Terminal discharge capacity is the capacity of a terminal to accommodate ships in the harbor, to discharge them, and to clear the cargo from the terminal. When the term "terminal discharge capacity" is used in this paragraph, it means the average number of long tons of general cargo that can be unloaded from vessels and/or lighters onto wharves and cleared from the wharf aprons in one 20-hour working day.

b. Basic Considerations. To make a water terminal discharge capacity estimate, the following basic considerations must be evaluated: the harbor berths and anchorage areas available, wharf capacity, lighterage discharge, and local conditions. These considerations often necessitate adjusting the accepted linear wharf

footage planning factor (c(1) and (2) below). The degree of adjusting required by each of these considerations will vary according to each situation.

- (1) *Berths and anchorages.* The first fact that must be determined is whether vessels can be brought into the anchorage areas and alongside the wharves. Berths and anchorages are evaluated according to the size of vessels they can accommodate (FM 101-10).
- (2) *Wharf capacity.* Terminal capacity estimates are based on the use of all available wharf facilities. All facilities suitable for handling general cargo should be included in the estimate—for example, open or covered terminals, naval wharves, ship repair and fitting-out wharves, bulk-cargo wharves, and special purpose wharves. If it is doubtful that a particular wharf can be used although its capacity has been included in the estimate, its inclusion should be explained. Weather (particularly extremes of weather) affects the capacity of a wharf. Wharf capacity is materially affected by the factors discussed below.
 - (a) *Type and layout.* The general term “wharf” includes both quays and piers. A quay is a wharf parallel with the shoreline of a basin or harbor with water and accommodations for ships on one side only. A pier is a wharf which projects into the harbor or basin with water and accommodations for ships on both sides. There are several kinds of piers, such as T-head, L-head, and marginal. The type of wharf and its layout must be considered when estimating wharf capacity. Layout includes adequacy of approaches, stacking space on the landward side, raised or depressed tracks, curbs, fences, deck surfacing material, transit shed space, number and size of transit shed doors, and the depth of high and low water alongside.
 - (b) *Alinement.* The alinement of the face of the wharf is an important factor. The angle points and curvatures along the wharf face must be considered. If they are excessive, the usable linear footage must be reduced appropriately.
 - (c) *Deck.*
 1. *Load capacity.* The load capacity of the wharf deck and of the transit shed floor is of prime importance. A rule-of-thumb method for determining whether the load capacity is adequate is the present use of the wharf. If the type of cargo normally handled can be

determined, a fair load capacity evaluation can be made.

2. *Height.* The height of the wharf deck must be considered in relation to the tidal rise.
- (d) *Working space.* The type of wharf, the width of the wharf apron, the wharf's decking, and the exits from the wharf determine the working space. To be adequate, the working space must be wide enough to allow general cargo to be unloaded and cleared without undue delay. A minimum width of 40 feet between the coping and any obstruction on the wharf is considered adequate. (A transit shed with numerous openings is not considered an obstruction.) When both sides of a wharf are to be used simultaneously, each side should have a clear 40-foot working space; however, if there are no obstructions on the wharf, a total working space of 70 feet is enough. Where shipside, double-track rail facilities are used, a 30-foot wharf apron is sufficient. Local customs, specialized wharves, and unusual construction may permit variations in these figures. The adequacy of the working space must be considered when estimating discharge capacity.
- (e) *Depths alongside.* Fluctuations in tide levels affect the discharge of cargo. This consideration is especially important where tidal variation is great and ships need the advantage of high tides to reach their berths. If the wharves are not located in wet docks and the tidal variations are extreme, the discharge capacity estimate should be adjusted to reflect this condition. The effective terminal discharge capacity may be reduced as much as 50 percent if alongside depths are reduced below the operable minimum by the tidal range. Under normal conditions the water should not be less than 30 feet deep at low tide. (A minimum of 30 feet is used for planning purposes because this depth accommodates virtually all deep-draft vessels.)
- (f) *Physical condition.* The physical condition of a wharf must be considered when evaluating its usefulness. Deterioration and/or damage may limit its capacity.
- (3) *Lighterage discharge.* Wharves used by lighters should be within a reasonable distance of a sufficient number of anchorages and moorings. Lighterage berths are assigned in units of 100 feet for each lighter (taken to the nearest 100-foot unit): this unit measurement must

be used realistically. Length of wharf over 100 feet and less than the next higher 100-foot unit is disregarded (a 360-foot wharf will accommodate 3 lighters at the same time). All alongside berths with depths of less than 18 feet are considered lighter berths.

- (4) *Local conditions.* Conditions vary with localities; sometimes the situation may be very unusual. When necessary, berth, wharf, and lighter discharge factors must be adjusted or reduced to meet emergencies imposed by local conditions.

c. Making the Estimate.

- (1) *Method.* To estimate terminal discharge capacity, multiply the adjusted linear wharf footage by the applicable factor or factors—alongside and/or lightering. The actual linear wharf footage available may have to be reduced because of one or more of the basic considerations discussed above. In addition to determining the adjusted linear wharf footage and applicable certain factors, certain basic assumptions must be made when estimating terminal discharge capacity. Factors, assumptions, and application are explained below.

(2) *Factors.*

- (a) *Alongside.* The discharge rate of 1.2 long tons of mixed general cargo for each adjusted linear foot of wharf per 20-hour day is the alongside factor. This is a conservative planning figure and ordinarily does not have to be reduced because a terminal is being used to its full capacity or because all the hatches of a ship are not being worked simultaneously.

- (b) *Lightering.* The discharge rate of 1.4 long tons per linear foot of wharf per 20-hour day is the lightering factor. This too is a conservative planning figure. Discharging cargo to a lighter in the stream requires extra handling of cargo; however, when the lighter is alongside the wharf, discharge is more rapid than from the hold of a ship, assuming that cranes are available. This is because the transfer of cargo from a lighter to a wharf is more direct than from a ship. In addition, lighters when unloaded can be replaced by loaded ones, whereas a five-hatch ship must continue to occupy a full berth even though four of the hatches have been unloaded.

- (3) *Assumptions.* It is assumed that:

- (a) Adequate labor, stevedore gear, harbor craft, lighters,

and the means of moving the lighters and cranes for discharging the lighters will be available.

- (b) Only ships' gear will be used to unload ships both alongside and in the stream; mobile or other light cranes will be used to discharge lighters alongside wharves.
 - (c) There will be 20 effective cargo-working hours per day.
 - (d) The operation will not be affected by variable factors, such as adverse sea and weather conditions, enemy interference, or civil requirements.
- (4) *Examples.*

(a) *Alongside discharge.*

1. *Problem.* What is the unloading capacity in long tons per day of a wharf where—

The actual wharf length is 1,500 feet, but the adjusted length is 1,200 feet

Ships are berthed alongside.

2. *Solution.* Using the alongside factor of 1.2 long tons, the capacity is 1,200 times 1.2 or 1,440 long tons per day.

(b) *Lighter discharge.*

1. *Problem.* What is the unloading capacity in long tons per day of a wharf where—

The actual wharf length is 1,500 feet, but the adjusted length is 1,200 feet.

Ships are anchored in the stream and lighters are used for the discharge of cargo.

2. *Solution.* Using the lightering factor of 1.4 long tons, the capacity is 1,200 times 1.4 or 1,680 long tons per day.

APPENDIX VI

RAILWAY INFORMATION REQUIREMENTS

1. Areawide Information

a. Essential railway information requirements include—

- (1) Relative importance of railway transportation in the national economy.
- (2) Relationship of railways to industry and agriculture.
- (3) Peacetime and wartime adequacy of railways.
- (4) Military potentialities—major improvement or development needed.

b. A general description and analysis of the railway transportation system is also essential including—

- (1) Relationship of railways to the other modes of transportation and the geographic distribution and density of railways and railway facilities.
- (2) Small scale annotated maps, charts, and diagrams showing rail lines, gages, track numbers, route mileages, track (single, double, multiple) and electrified sections, operating divisions and mileages, important stations and junctions, branch lines, transfer points, critical bridges, limiting structures, and other facilities.
- (3) Tabulations of railway mileages by systems (consisting of connected lines of one gage), lines, and operating divisions; by single, double, multiple, and electrified trackage of the same gage; by total track miles and total route miles; by lines planned and under construction; and by ownership (governmental or private).
- (4) Details of electrification including general policy and trends, location of electrified sections, power source(s), current characteristics and operating voltages, distribution system, method of current distribution (third rail, etc.), and alternate power sources.
- (5) Discussion of common features of the railway network signaling and communications system and facilities, including—
 - (a) Nature and extent of communications and the railway

sections in which radio, telegraph, or telephone communications exist.

- (b) Methods of protecting train movements on running tracks, signal system and signaling devices, interlocking switches and signals, control points and connecting circuits, rules and operating procedures, and related data.
 - (6) Discussion of official construction standards and design specifications for railways, including roadbeds, bridges, tunnels, ferries, and other railway structures and facilities, and an analysis of the extent to which they are followed.
 - (7) Status and scheduling of current projects and proposed plans for the development or improvement of railways and railway transportation.
 - (8) Analysis of transportability factors: description and milepost location of controlling restrictions on each rail line, structure clearance, equipment, and maximum loading diagrams (fig. 7).
 - (9) General condition of the railway system, including an analysis of transportation capabilities, potentialities for military use, and principal limiting factors.
 - (10) Details of standardization, interchange, and multigage features of railroad equipment.
 - (11) Details of freight handling (loading, unloading, and transfer of loads) and handling equipment.
 - (12) Description of the organization, training, operations, and capabilities of railway transportation units in the country's military service, including copies of tables of organization and equipment, field and technical manuals, and related doctrine.
 - (13) Connections and interchange with adjacent rail systems, including international connections and equipment exchange and transfer facilities.
 - (14) Explanation of local terms and terminology used in describing railways and railway transportation activities.
- c. Organization and administration of railways and railway transportation, including—
- (1) Ownership (governmental or private); policy, extent, and effect of government control; and foreign interests and influences.
 - (2) Identity, location, and organization charts of agencies responsible for control and administration of railway

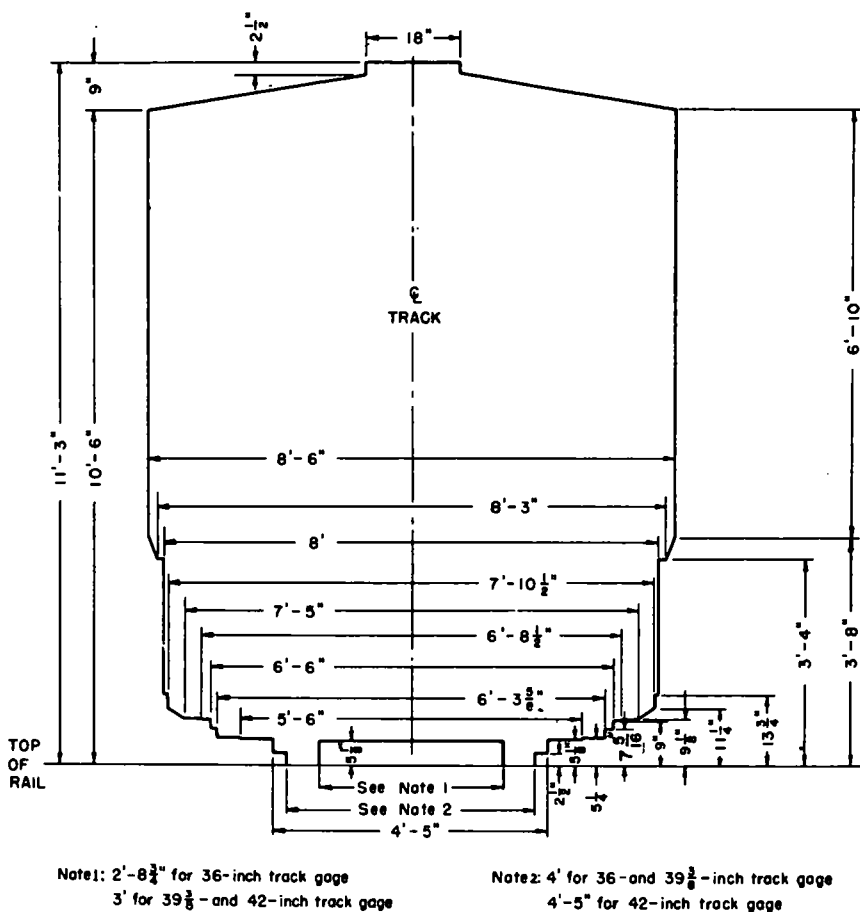


Figure 7. A composite clearance diagram.

transportation and a discussion of functions and programs.

- (3) Number of railway personnel by departments and divisions, their training and education, and any political influence on appointment of key operating officials.
- (4) Number of skilled and unskilled laborers, location of recruiting centers, training and experience, working conditions and wage scales, organization of train crews and maintenance crews, and dissident and sympathetic elements.
- (5) Railway financial data, including operating and fiscal statistical railway records, rate tables, and rate fixing

methods; government regulations affecting railway rates, operations, and accounting.

d. Status of railway construction, maintenance, and repair activities, including—

- (1) Government policy, organization, funding, and procedures for initiation and execution of reconstruction; new construction; and maintenance and repair projects.
- (2) General availability and quality of construction and maintenance equipment, materials, and labor—including sources of supply, efficiency of operations, construction skills, and statistics on equipment production.
- (3) Railway construction and maintenance problems, procedures, and standards peculiar to the country and area.

e. Railway transportation research and development program, including—

- (1) Research and development policy, trends, objectives, and capabilities.
- (2) Testing and development centers, facilities, equipment, and key personnel.
- (3) Current railway research and development projects and progress being made.

2. Detailed Description of Individual Railway Lines and Equipment

a. Line Identification and Description.

- (1) Railway system: name and gage.
- (2) Railway line number, length, terminals, ownership, and importance.
- (3) Operating divisions or foreign equivalent: number, length, terminals, and motive power in service by types.
- (4) Railroad line characteristics and facilities by operating divisions, including axleload limitations by line.
- (5) Details and scheduling of new construction or improvements planned, underway, or completed (with dates).
- (6) Data concerning structures and crossings (bridges, ferries, etc.), including prevailing types and lengths, general condition, load capacity, total structures of each type, total length of bridges and tunnels, and similar statistics.
- (7) Distances between all important junctions.
- (8) Milepost location, description and photographs of all weight or clearance limiting structures, projections and obstructions (bridges, tunnels, station platforms, buildings, rock cuts, overhead structures, etc.) that restrict

the size and dimensions of rolling equipment and loads that can be moved over the railway lines (fig. 7).

- (9) Number of tracks and gage of each.
- (10) Weight, type, and dimensions of rails.
- (11) Ruling grades and curve radii (degree of curvature).
- (12) Ties (type, number per mile, preservative treatment), whether or not tie plates are used, type of ballast.
- (13) Sidings and passing tracks: locations, lengths.
- (14) Drainage facilities, including culverts.
- (15) Places on line that are potential nuclear targets.
- (16) Operating, repair, and maintenance facilities, such as—
 - (a) Data on freight and passenger depots (waiting rooms, intransit storage).
 - (b) Icing facilities.
 - (c) Source and adequacy of power equipment and skilled labor.
 - (d) Administrative, servicing, and repair facilities, including offices; roundhouses; turntables; shops; back shops; mobile wrecking and repair equipment; stocks of repair parts, structural materials, and supplies; system and efficiency of shop operation.
 - (e) Signal, traffic control, and dispatching facilities.
 - (f) Roadway and track maintenance: materials and equipment used and methods and frequency of—
 - 1. Renewal and maintenance of rails, including rail joints and accessories.
 - 2. Crosstie and switch-tie renewal.
 - 3. Ballast application and cleaning.
 - 4. Switch, frog, and crossing maintenance and replacement.
 - 5. Roadbed maintenance, including drainage and ditching.
 - 6. Removal of weeds, snow and ice, and other impediments.
- (17) Railway traffic and operations data about—
 - (a) Type and volume of cargo and passengers hauled annually, including data pertaining to freight ton-miles hauled (net and gross), total tonnage by commodity; average time and distance of freight haul, freight car loadings, average turnaround time, and passenger-miles traveled.
 - (b) General conditions and capabilities of the railway line and operating divisions, including average number and kind of trains moving in each direction per 24 hours;

the number of cars and net train load; train length and running time; average and maximum train speeds and weights; and net daily line-tonnage.

- (c) Description and analysis of serious traffic interruptions and control measures, with data showing incidence by cause, season, and area of occurrence.
- (d) Location and description of principal limiting features, such as ruling grades, curves, clearances, capacities, and speeds.
- (e) Type of train control on each line: automatic block, manual block, centralized traffic control, train orders, timetable, etc.
- (f) Operating rules, regulations, methods, and procedures.

b. Bridges.

(1) Location and identification.

- (a) Line number, section, and operating division.
- (b) Structure name, number, or other identification.
- (c) Coordinates and mile or kilometer station.
- (d) Stream, road, or body of water crossed.
- (e) Map and photographic references.

(2) Characteristics.

- (a) Type of bridge including material, construction, and whether fixed or movable.
- (b) Length between abutments and overall length—including approach spans.
- (c) Number, type, and length of spans.
- (d) Size and type of abutments and piers.
- (e) Alinement, gradient, and curvature of approaches.
- (f) Traffic data: number of tracks, axleload limits, permissible speeds, distance between track centers if double track, vertical and horizontal clearances, date built or rehabilitated, and present condition (dated).
- (g) Alternate routes and distances.
- (h) Basic documents, including clearance diagram, bridge book, photographs, and construction plan.

c. Tunnels.

(1) Location and identification (same as in *b*(1) above).

(2) Characteristics.

- (a) Length, number of tracks, and distance between track centers if double track.
- (b) Vertical and horizontal clearances, minimum radius of curvature, and maximum gradient.
- (c) Present condition, details of drainage and ventilation, and standard of maintenance.
- (d) Any unusual features or facilities.

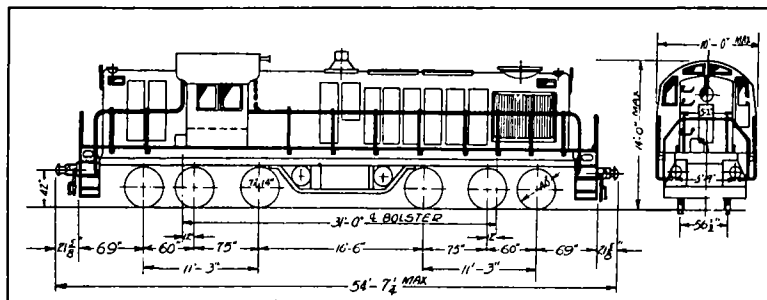
- (e) Alternate routes and distances.
- (f) Clearances, diagrams, photographs, and construction plans.

d. Train Ferries.

- (1) Location and identification (same as *b*(1) above).
- (2) Ferry route details.
 - (a) Names of terminals and water distances between them.
 - (b) Periods usable.
 - (c) Possible alternate routes or crossing points.
- (3) Ferry inventory and characteristics.
 - (a) Name, age, condition, railway car and locomotive capacity and maximum permissible loading in gross and net tons for each ferry.
 - (b) Description of ferries: length, beam, and draft; type motive power and horsepower; fuel type and capacity; speed; method of unloading (side or end); number, length, and arrangement of tracks; details of the aprons; size and weight of largest item handled; number and type of operating personnel; special features of ferry design or operation.
 - (c) Traffic statistics.
 - 1. Nature, volume, and density of ferry traffic.
 - 2. Crossing time (light and loaded) and roundtrip time, including time for loading, mooring, and unloading.
 - 3. Traffic interruption factors and incidence.
 - (d) Terminal facilities.
 - 1. Name, location, and importance.
 - 2. Details of docking facilities, operating personnel and equipment, and operating capability and limitations.
 - 3. Potentialities for military use.

e. Yards and Terminals.

- (1) Name, location, and importance.
- (2) Number, length, and car capacity of tracks at each location by type—including receiving, classification, outbound and storage, and other tracks (rip, scale, icing, pen, shop, engine, diesel, coach, team, industry, roundhouse, turntable, and wye).
- (3) Switching method and rate (flat and hump), hump location and gradient (manual or mechanical hump), type and location of retarder (braking device), normal working hours, and number of switch engines worked.
- (4) Classification-yard capacity in cars handled per day.
- (5) Operating rules, methods, procedures, and limiting factors.



Weights

On driver, 252,000 lb (1/2 tank)
 Total locomotive, 252,000 lb (1/2 tank)
 Maximum axle limitation, 22 short tons
 Horsepower, 1,000 bhp
 Maximum speed restriction, 60 mph

Engine

Type, 6-cylinder, supercharged, 4-cycle
 Cylinders, 6
 Cylinder, bore and stroke—12 1/2" x 13"
 Displacement, 9,550 cu in.

Electrical

Generator, 1,350 amperes
 Exciter, 65 amperes
 Motors, 740 amperes
 Control equipment, type "P," 1 on right side
 Radiator fan, large diameter, engine-driven
 Batteries, 32-cell, 64-volt
 Lighting circuit, 60-volt
 Headlight, 250-watt

Capacity

Fuel, 1,600 gal.
 Cooling water, 240 gal.
 Lubricating oil, 80 gal.
 Sand, 27 cu ft

Tractive effort

Starting, 63,500 lb
 5 mph, 40,000 lb

Airbrake

Schedule, Westinghouse, EL-14 type
 Brake cylinders, 8" x 10" x 10", type "B"
 Pumps, 83 cu ft per minute
 Pump capacity at full engine speed, 228 cu ft per minute
 Reservoir capacity, 69,800 cu in.
 Handbrake, connected to one truck

Trucks

Type, two 6-wheel swivel equal, rigid bolster, pedestal

Wheels, 6 pair, 40", rolled steel

Brake cylinders, eight 10" x 10", type "B"

Limiting dimensions

Maximum radius of curvature (locomotive alone), 25°
 Gage, 4' 8 1/2"

Sanders, 8 sander traps

Traction motor blower, B. F. Sturtevant Company

Draft gear, spring type

Coupler, screw link and hook type

Figure 8. Sample report: diesel-electric locomotive, 0-6-6-0 type.

- (6) Details of signaling and communication system employed.
 - (7) Location, type, characteristics, and capacity of storage, warehousing, service and repair facilities.
- f. Fuel and Water Stations.*
- (1) Location, type, servicing capacity and limiting factors.
 - (2) Source, method, and adequacy of water and fuel supply.
 - (3) Water treatment required (at specific locations) before use in locomotives.
- g. Stations.*
- (1) Location, type (passenger or freight), and capacity.
 - (2) Type platforms, height and clearance.
 - (3) Type and number of tracks.
 - (4) Storage, warehouse, and heavy lift facilities.
- h. Passing Tracks on Single-Track Lines.*
- (1) Capacity at each location.
 - (2) Distances between passing track locations.
 - (3) Minimum length of passing tracks and location.
- i. Electrified Sections.*
- j. Signaling and Communications Facilities.*
- k. Miscellaneous Facilities.*
- (1) Sanding facilities: location, capacities, and types.
 - (2) Nature, location, and capacity of wye tracks and other turning facilities.
 - (3) Snowsheds, retaining walls, etc. Description should include location, dimensions, clearances, type material, and construction.
 - (4) Special equipment and operating personnel, including location, characteristics, and inventory of work cranes, snowplows, rail detectors, hospital trains, track-laying equipment, etc.
- l. Equipment Characteristics and Inventory (figs. 8-10). Information collected should include facts about—*
- (1) *Characteristics.*
 - (a) *Locomotives.* Type of locomotive, gage, tractive effort (starting and continuous), wheel arrangement and size, overall length, fuel, horsepower, manufacturer, markings and nameplate data, year built or put into service, type of fuel required, and any other pertinent data, such as water treatment.
 - (b) *Cars.* Type (passenger and freight), type of coupler and height above rail, side or center buffers (if side buffers, give horizontal bracing), type of brakes,

gage, number of axles, type of journals, overall dimensions, capacity, manufacturer, markings, and year built or put into service. For freight cars, also give type (box, flat, gondola, tank, etc.), load limit (volume and weight), tare weight, commodity for which car is designed and openings (number, size, and types of doors, vents, etc.).

(c) *Special equipment.*

1. *Self-propelled rail cars.* Total number, weight, dimensions, capacity, horsepower, manufacturer, markings data, year built or put into service.
2. *Wreckers (crane).* Type (steam, diesel, diesel-electric), lifting capacity, weight, length of boom, wheel arrangement.
3. *Hospital train.* Litter capacity, kitchen facilities, type of power car.
4. *Snowplows.* Rotary blade, V-blade, V-blade and spreader, V-blade with ice-cutting attachment.
5. *Weed control.* Weed burner (fuel), wood sprayer (chemical).
6. *Special purpose freight cars.* Cars for carrying over-size, cumbersome, odorous, explosive, corrosive, or contaminated cargo.
7. *Miscellaneous.* Train ferries, car floats, track-laying, inspection and maintenance cars, rail detectors, clearance feelers, switchers, wheel grinders, couplers, and buffers.

(2) *Manufacture and procurement.*

- (a) Principal domestic manufacturers: location, production statistics, and capacity of plants.
 - (b) Foreign sources, if any, and agencies responsible for procurement.
- (3) *Maintenance.* Responsible agencies, policies and procedures, standards, adequacy of facilities, availability of materials and trained personnel.
- (4) *Statistics.* Number and type of locomotives, rolling stock, and special equipment in operation, awaiting repair, and out of service at any one time.

*Figure 9. Sample report: 30-ton boxcar.
(Located in back of manual)*

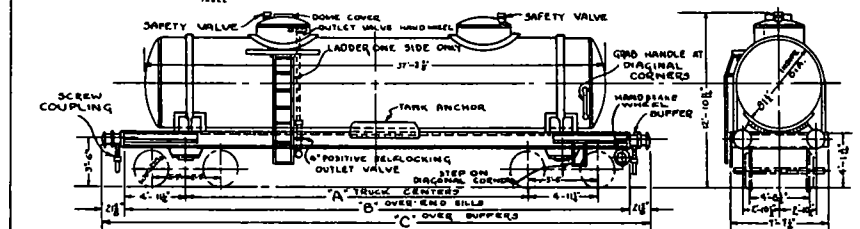
3. Information Sources

a. *Documents.* Maps, photographs, and basic documents of each railway system are required that show—

NOTE:

U.S. NO.	U.S. A. NO.	"A"	"B"	"C"	DEL. DATE
18752	1000-1000	37'-10-1/2"	37'-2-3/4"	40'-0"	JUL. 1952
18753	1000-1000	37'-0"	37'-2-1/2"	40'-0"	JUL. 1952
18917	10010-10722	37'-0"	37'-2-1/2"	40'-0"	MAY. 1951
18917	10722-10722	37'-0"	37'-2-1/2"	40'-0"	MAY. 1951

TABLE



Gage, 4' 8 1/2"

Load limit, 40 tons

Capacity, 1,290 cu ft, 9,900 gal.

Light weight, 40,000 lb

Inside dimensions

Length of tank, 37' 2 3/8"

Diameter of tank, 6' 9 1/2"

Diameter of dome, 4' 0"

Outside dimensions

Overall length over sills (see note)

Overall length over buffers (see note)

Width at end sills, 7' 7 3/4"

Extreme width, 8' 2"

Overall height from rail

To extreme width, 1' 6"

To top of tank, 11' 9 1/16"

Extreme height, 12' 10 11/16"

Number of axles, 4

Wheels, 650 lb, 33" diameter, cast iron

Size of journals, 5" x 9", AAR

Type of brakes, air (with vacuum line)

Type of couplers, screw coupling

Safety valves, tested at 24 lb

Tank, tested at 60 lb

Number of domes, 2

Underframe, built-up steel

Center sill, two 12 13" back-to-back channels,

16

each at 31.3 lb per linear ft

Side sill, 10" channel at 15.3 lb per linear ft

(from end sill to bolster)

End sill, 5" formed plate

16

Bolster, 1/4" steel pressing

Cross bearer, none

Cross tie, none

Tank shell

Top and side sheets, 1/4" steel

Bottom sheet, 3/8" steel

Tank head, 3/8" steel

Tank dome, 1/4" steel, 48" diameter

Safety valve, 5" with resilient gasket

Outlet valve, 4" self-locking type

Dome cover, on one dome only

Truck side frame, cast steel (with integral journal boxes)

Side bearing, friction type

Figure 10. Sample report: 9,900-gallon tank car.

- (1) Line profiles; track charts; structures, loading, and equipment clearance diagrams.
- (2) Tunnel, bridge, and equipment registers.
- (3) Signaling, standard plan, rule, and station diagram books.
- (4) Current railroad maps and aerial and ground photographs.
- (5) Passenger and operating (trainmen's) timetables.
- (6) Railway engineering texts, technical and scientific treatises, and brochures.
- (7) Train sheets, railway operations data, and traffic flow charts.
- (8) Reports: route, reconnaissance, construction plans and progress, and annual reports.
- (9) International railway agreements.
- (10) Organizational charts; facility plans and layouts.
- (11) Railway equipment manufacturers' brochures, catalogs, service and maintenance manuals, operating instructions, specifications and drawings, pilot models, and prototypes.
- (12) Statistical publications, tariff regulations, and rate schedules.

b. Agencies.

- (1) The officials in control—governmental or private. These officials are responsible for policy and procedure, administration, finances, personnel, public relations, operating rules and regulations, traffic operations, construction and maintenance, rolling stock, and research and development.
- (2) Divisional and regional officials responsible for implementing the functions described in *a* above.
- (3) Train crew (engineers, conductors, brakemen); station and yard masters; construction and maintenance units and personnel.
- (4) Manufacturers of locomotives, rolling stock, and equipment.
- (5) Major shippers and shippers' associations.

4. Estimating Railway Capacity

a. General. Even though the amount and quality of technical information available for analysis varies, a standardized method of approach insures use of the same principles of evaluation. The evaluation methods discussed in this paragraph are applicable

primarily to the problem of determining the enemy's logistical capability by rail. In general rail capability depends upon net division tonnage, terminal facilities, and service and repair facilities. The intelligence data needed to estimate a railway's capacity can be produced by following the procedures described below.

b. Net Division Tonnage. Net division tonnage is the tonnage (short tons), or payload, that can be moved over a railway division each day. To calculate net division tonnage, basic assumptions must be made and essential factors considered.

(1) *Basic assumptions.* A study of a capacity problem must be accompanied by a statement of the assumptions upon which the suggested solution is based. The assumptions listed below may be considered basic ones in the solving of rail capacity problems; however, conditions may necessitate the making of other assumptions. Generally, it may be assumed that:

- (a) An adequate number of freight cars and locomotives will be available.
- (b) An adequate number of qualified personnel will be available.
- (c) All trains will be freight trains or will be operated at freight-train speed.
- (d) Enemy action will not interrupt operations.
- (e) Operations will continue more than 72 hours.

(2) *Essential factors.*

(a) *General.* Net trainload and train density are essential factors in determining net division tonnage. The net trainload is the net tonnage that can be carried by each train. Train density is the number of trains that can be operated each way over a line in a 24-hour period.

(b) *Net trainload.*

1. *General.* Net trainload is the payload carried by the train. The total weight of the cars under load is the gross weight; the weight of the cars empty is tare or light weight. The difference between these two is the net load (payload) of a train. (Generally the payload is 55 percent of the gross trailing load.) Tractive effect (TE) and gross trailing load (GTL) are important factors that must be considered in calculating the net trainload. The length of passing sidings on a line and the effect of weather are also factors which must be considered.

2. *Tractive effort.* Tractive effort is the horizontal force

which a locomotive can exert provided its wheels do not slip. The tractive effort figure used should be that of the type of freight locomotives used on the railway being studied. If the tractive effort of a locomotive is not furnished by some reliable source, such as the manufacturer, it can be computed by using known locomotive characteristics or by rule-of-thumb method (FM 55-21). Tractive effort is classed as starting and continuous. The former is the effort required to start the locomotive; the latter is the effort required to keep the locomotive moving. Generally starting tractive effort is equal to or greater than the continuous tractive effort. The starting tractive effort on the level should be compared with the continuous tractive effort required to keep the same train moving on the ruling grade of a line. The larger tractive effort required will control the size of the train. Therefore, the analyst must bear in mind the ruling grade of the line under study. However, because of the many variables involved, the following discussion of tractive effort does not include the effect of the ruling grade of a line; only level track is considered. Consequently, in this discussion the starting tractive effort is considered the controlling factor in determining the pulling power of a locomotive. Steps in computing tractive effort, using known locomotive characteristics, are described below according to type of locomotive.

- (a) *Steam locomotive.* The effective energy at the wheel rim is reduced because of friction of the piston, piston rod, crosshead, and the various bearings. The steam pressure in the cylinder is always less than that in the boiler, even at low speed and full cutoff. These reductions may be allowed for by figuring the steam pressure (effective at the drivers) to be 85 percent of the boiler pressure. The rated, or starting, tractive effort may be determined by using the formula given below. It may be used with no appreciable inaccuracy up to speeds of 15 miles per hour. One of the limiting factors of tractive effort is the frictional force, or adhesion, between drivers and rail. This is a function of the weight on drivers and of the coefficient of friction between the wheel and the rail. An average value of 0.25 is generally used for the latter; the corresponding reciprocal

of the coefficient of friction is known as the factor of adhesion. The formula for determining starting tractive effort of a steam locomotive is—

$$TE = \frac{0.85 \times P \times d^2 \times S}{D}$$

where

TE = tractive effort in pounds

P = boiler pressure in pounds per square inch

d = diameter of cylinders in inches

S = length of piston stroke in inches

D = diameter of drivers in inches

A close approximation of the starting tractive effort may be obtained by using the simple formula of—

$$TE = 0.25 \times W$$

where

W = the weight of the locomotive on the drivers (adhesive weight).

The adhesive weight of a locomotive can be approximated by using the following information.

Wheel arrangement of locomotive	Percent of weight on drivers	Wheel arrangement of locomotive	Percent of weight on drivers
0-4-0	100	2-8-2	73
2-4-0	80	2-8-4	61
2-4-2	57	4-8-0	80
4-4-0	67	4-8-2	67
0-6-0	100	4-8-4	57
0-6-2	75	0-10-0	100
2-6-0	86	0-10-2	83
2-6-2	87	0-10-4	71
4-6-0	75	2-10-0	91
4-6-2	60	2-10-2	77
0-8-0	100	2-10-4	67
0-8-2	80	4-10-0	83
0-8-4	67	4-10-2	72
2-8-0	89	4-10-4	62

- (b) *Diesel-electric locomotive.* Tractive effort curves are computed from data on generator-traction motors and auxiliaries with an overall limitation imposed by the horsepower rating of the diesel engine. These curves are furnished by locomotive manufacturers. Whenever possible, diesel-electric locomotive tractive effort should be obtained from these curves. If such curves are not available, starting tractive effort can be approximated by dividing the adhesive weight of the locomotive by 3. The continuous tractive effort can be approximated by dividing the adhesive weight by 6.

- (c) *Electric locomotives.* The tractive effort for an electric locomotive is governed by the amount of power supplied to the motor and by the capability of the motor. Manufacturers of electric locomotives prepare tractive-effort curves that should be used when available. These curves are usually based on substation voltage. Because of transmission losses, it is recommended that the values taken from these curves be reduced by 10 percent. Tractive effort may also be obtained by equating work done at the rim of the driving wheels to the work produced by the motor torque in one revolution of the driving wheels. The following formula gives hourly tractive effort: this can be considered the starting tractive effort.

$$TE = \frac{T \times 24 \times G \times E \times N}{D \times g}$$

where

- TE = tractive effort in pounds
 $T \times 24$ = torque of a single motor. (Torque is taken at a 1-foot radius from the armature shaft center.)
 G = number of teeth in the driving gear
 E = combined electrical and mechanical efficiency (averages 80 to 85 percent)
 N = number of motors
 D = driving wheel diameter in inches
 g = number of teeth in the pinion gear.

Continuous tractive effort for speeds between 5 and 10 miles per hour can be approximated by dividing the adhesive weight by 3.

3. *Gross trailing load.* This is the maximum weight a locomotive is capable of pulling. The gross trailing load is affected by locomotive tractive effort, train resistance, grade resistance, and weight of locomotive and tender. The gross trailing load (GTL) is calculated by using the following formula:

$$GTL = \frac{TE}{TR + GR} - W$$

where

- GTL = gross trailing load in short tons
 TE = locomotive tractive effort in pounds
 TR = train resistance. (This factor depends on the weight per car and the speed of the train. A resistance of 4 pounds per ton is considered an acceptable average

when the speed of a train is from 5 to 15 miles per hour and the weight per car is 30 to 50 tons.)

GR = grade resistance. (This is found by multiplying 20 pounds per ton of train times the grade in percent.)

W = weight of locomotive and tender in short tons.

4. *Length of sidings.* The net trainload is sometimes limited by the length of the passing sidings on the line. The minimum length of passing sidings should be compared with the length of train needed to carry the planned net tonnage. To do this, estimate the average freight car length and load per car.

5. *Effects of weather.* Snow, ice, and freezing temperature affect train locomotives and operations, thereby reducing net tonnage. For winter operations, net tonnage should be reduced as shown below. (A reduction may not have to be made if the net trainload has already been reduced because of the siding lengths.)

Temperature		Percent of reduction in locomotive tonnage rating
Fahrenheit	Centigrade	
Above 30	Above —1	0
29 to 20	—2 to —7	10
19 to 10	—8 to —13	20
9 to 0	—14 to —18	30
—1 to —10	—19 to —23	35
—11 to —20	—24 to —29	40

(c) *Train density.* Train density varies greatly on different divisions—depending upon the type of line; number and location of passing tracks; train movement control facilities and procedures; and availability of train crews, motive power, and rolling stock.

1. *Single-track line.* The number of trains that can be operated in one direction on a single-track line in 24 hours depends on the speed of the trains, the maximum distance between passing sidings, and the delay time spent in a siding to allow other trains to pass. Additional time must be allowed for operating delays. The relationship of these various factors is shown by the following formula:

$$N = \frac{720 \times EF}{RT + DT}$$

where

N = train density in number of trains each way per day.

RT = running time in minutes over longest distance between passing sidings on line. (Speed of

train is usually considered as 15 mph—an average for war conditions. The speed might be 20 mph on an electrified line in good condition.)

DT = delay time in minutes. (This is for meeting with trains from the opposite direction. It may vary from 0 to 15 minutes, depending on type of track and control: no delay occurs where there are long passing tracks and centralized traffic control, whereas delays of as much as 15 minutes may occur on undeveloped lines.)

EF = efficiency factor. (This factor takes care of operating delays; it varies from 0.5 to 0.85 according to the type of signaling used. EF 's for the various types of signaling are: telephone and ticket, and rudimentary, 0.5; manual block, 0.6; automatic, 0.75; and centralized traffic control, 0.85.)

2. *Double-track line.* Estimates of maximum train density on double-track lines often vary greatly because these estimates, unlike those for single-track lines, are based largely on individual judgment. Assuming the use of an absolute blocking signal system on a double-track line, theoretically the type and interval of signals and the speed of the train are the only limiting factors. On a line that uses permissive blocking, train density is limited only by the braking distance between successive trains. Visibility and speed determine the braking distance. The possible train density of a double-track line is usually greater than the number of trains that can be assembled in the yards. The efficiency factor is the same for a double-track as for a single-track line (1 above). The capacity of the yards and line may exceed the number of locomotives that can be serviced in existing facilities. Therefore it is necessary to calculate the capabilities of yard and terminal servicing facilities for each double-track line under consideration and to select the lowest capability as the limiting factor.

c. *Terminal Facilities.*

(1) *Classification yard.*

- (a) The tonnage that can be classified and handled in a yard depends upon the total number of cars that can be held and operated in it. To estimate the tonnage

capacity of a yard—

1. Determine the total trackage of the yard.
 2. Multiply the total trackage figure by 0.60.
 3. Convert this new trackage figure to numbers of cars by dividing it by the average length of the freight cars used on the line.
 4. Determine the operational capability of the yard by multiplying its holding capacity in number of cars by its turnover factor. (The turnover factor, which means the number of times the holding capacity can be replaced daily, may vary from 2.0 for a hump yard with automatic facilities to as low as 0.8 for a flat yard with rudimentary operations.)
- (b) This estimated yard capability should be checked against the line capability to make sure the yard will support the line operations.
- (2) *Relay yard.* A relay yard is used to receive, service, and forward through trains: each train is kept intact. Car classification in these yards is not necessary. An appraisal must be made in each operation to determine which yards should be designated as relay yards. Operations in relay yards require an average time delay of 3 hours per train. This gives a train turnover factor of about 8 for a 24-hour period.

d. Service and Repair Facilities. The various distinctions made in classes of repair—not only worldwide but even on one railway—make it very difficult to estimate the maximum capabilities of railway servicing facilities. It is necessary, however, when studying the capabilities of a railway to estimate its service and repair facilities. This problem cannot be reduced to a formula; estimates of servicing capabilities must be based largely upon good judgment and experience. For example, a 2 to 4 turnover factor in 24 hours is usual for enginehouses: servicing a locomotive requires from 6 to 12 hours. Nevertheless, the capability to provide locomotives for line operations is not determined solely by the number of hours required to service a road engine because allowance must be made for the servicing of branch line and yard locomotives also. Care must be exercised not to overestimate servicing and repair facilities when estimating maximum train density.

APPENDIX VII

MISCELLANEOUS TRANSPORTATION INFORMATION REQUIREMENTS

Transportation information should be collected in coordination with the technical service or agency responsible for operation of the modes discussed below.

1. Pipelines

The type of information listed below should be collected.

a. Name, terminal locations, fluid transported.

b. Route, length of line and of sections.

c. Number, diameter, type of construction (welded or coupled), and pressure capacity of pipes; delivery capacity of system under all conditions (gallons per day for liquid, cubic feet per day for gas); capacity of line when full. A guide for estimating pipeline liquid capacity is given below.

Diameter of pipe (in.)	Daily capacity				
	Gallons (bulk)	Short tons			
		83 octane gasoline		Lubricating oil	
		Bulk	In 5-gal. cans	Bulk	In 5-gal. cans
4	304,000	930	1,260	1,150	1,480
6	655,000	2,000	2,730	2,500	3,210
8	1,135,000	3,500	4,730	4,350	5,580

d. Facilities at receiving end—including storage facilities. When a pipeline terminates at a port, data on connections from ship to shore should also be included.

e. Storage facilities along the pipeline. This should include location, nature, and capacity of individual storage units and of total storage capacity at each location.

f. Critical points, such as swamps, defiles, and elevations along pipeline.

g. Pumping stations—including location, capacity, and equipment data.

h. Maintenance and repair facilities, including shops; data for any needed repairs or improvements.

2. Pack and Draft Animals

Pack and draft animals include horses, mules, dogs, and other animals that may be used in this manner. Information concerning these animals should include—

- a.* Height and weight.
- b.* Rate of march and load-carrying capacity (personnel and/or equipment).
- c.* Food and water required per day.
- d.* Number available and noneffective rate.
- e.* Average daily distance for different terrain, gradeability.
- f.* Transportability of the animals.

3. Human Bearers

In some areas of the world, human bearers are used extensively. The transportation intelligence officer should be prepared to furnish information about—

- a.* Average cargo loads for male and female bearers; type of equipment used.
- b.* Bearers required for each litter team.
- c.* Degree of supervision required.
- d.* Number available, noneffective rate, and replacement capability.
- e.* Average rate of march for different conditions of terrain and weather.

4. Cableways or Tramways

Cableways or tramways are used in mountainous and beach areas. Information collected about these systems should include—

- a.* Location of the cableway or tramway.
- b.* Distance of operation over water and/or land.
- c.* Average daily tonnage capacity.
- d.* Maximum single lift of the system.
- e.* Equipment and personnel required to operate and maintain the system.

5. Sled Trains

Sled trains are used in arctic or subarctic areas. Information should include—

a. Characteristics of prime movers.

- (1) Weight and dimensions.
- (2) Carrying capacity: crew, passengers, and cargo.
- (3) Fuel capacity, speed, and miles per gallon.
- (4) Drawbar pull.
- (5) Turning radius.
- (6) Towed payload.
- (7) Oil and grease consumption.

b. Characteristics of sleds.

- (1) Weight and dimensions.
- (2) Load-carrying capacity.
- (3) Details of construction (special-purpose sleds, etc.).

6. Missiles

Rockets or other type missiles may be used to transport cargo, personnel, or messages. Information about these modes of transport should include—

a. Origins and destinations.

b. Estimated capability: type and size of payload, time and space factors.

c. Number of missiles available to the enemy.

d. Other transportation facilities and requirements related to, or necessary for, this mode of transport.

e. Effect of outside influences (weather, terrain, etc.) upon the employment of missiles for transport purposes.

APPENDIX VIII
SAMPLE INTELLIGENCE PHOTOGRAPHS

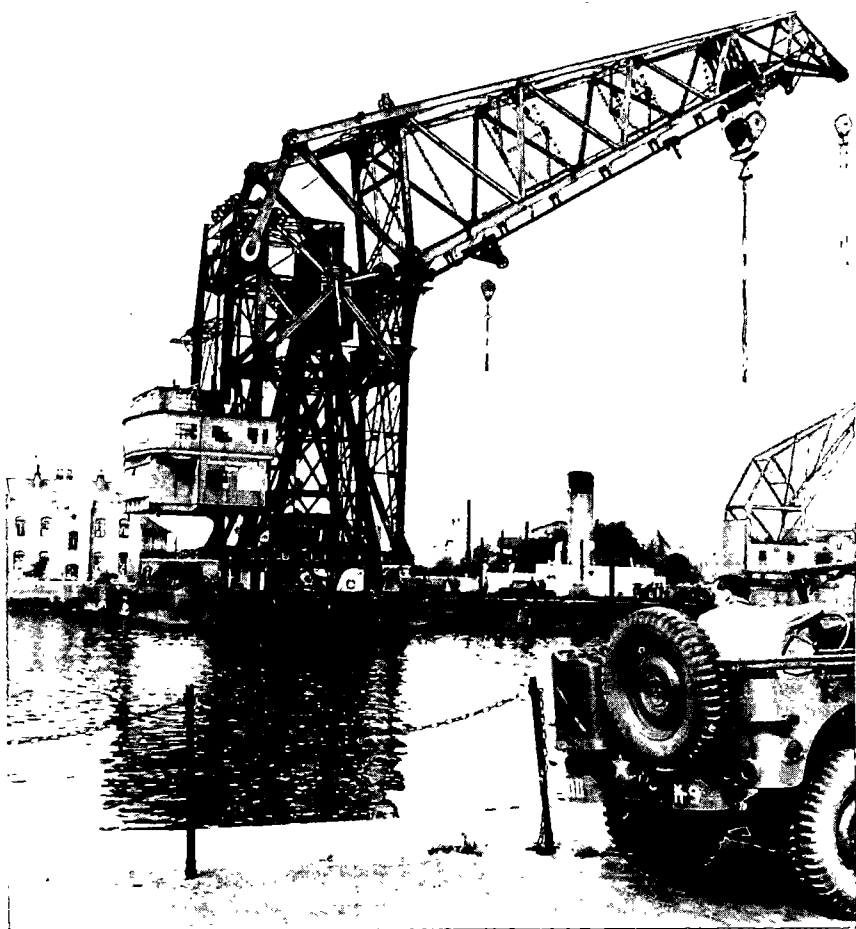


Figure 11. A 250-ton floating crane.

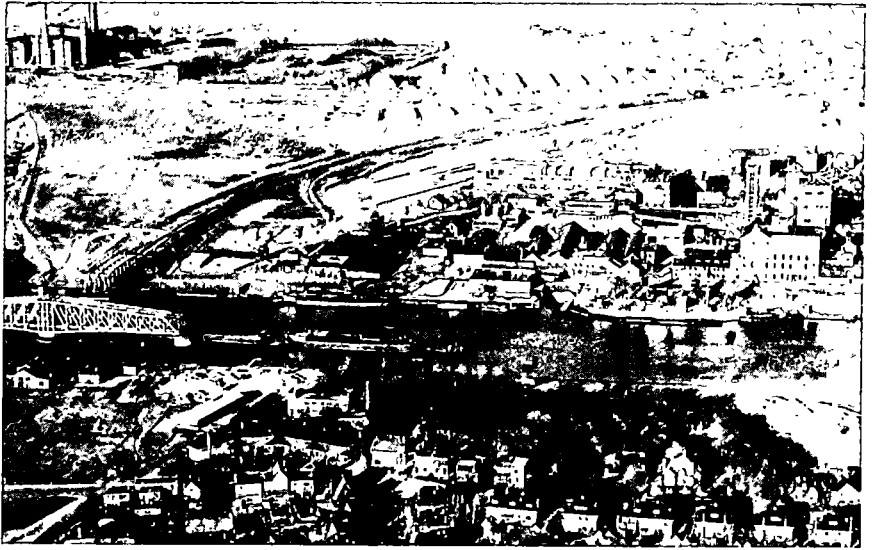


Figure 12. Inland waterway terminal: swing span, rail yards, factories, and residential area.

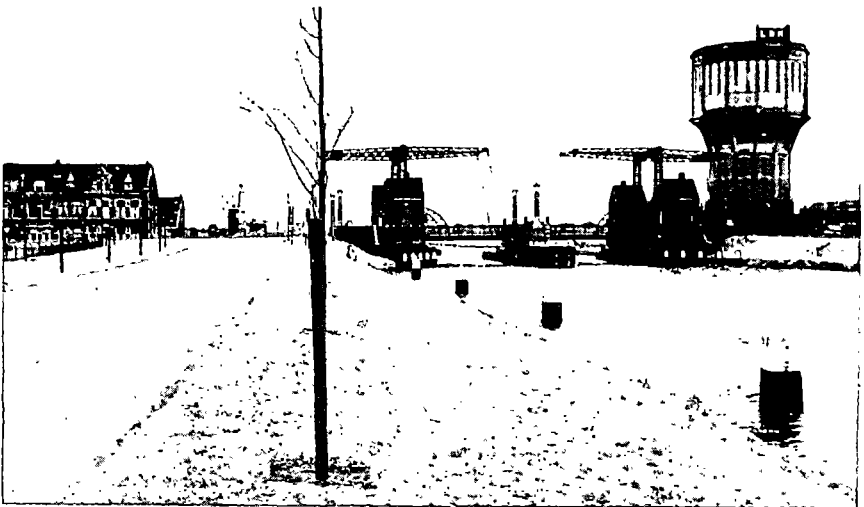


Figure 13. Double-leaf bascule span with overhead counter-balances.

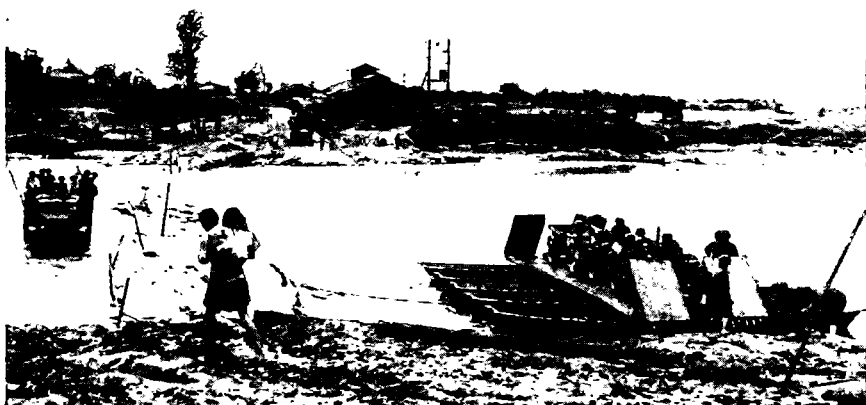


Figure 14. Ferry and underwater bridge.

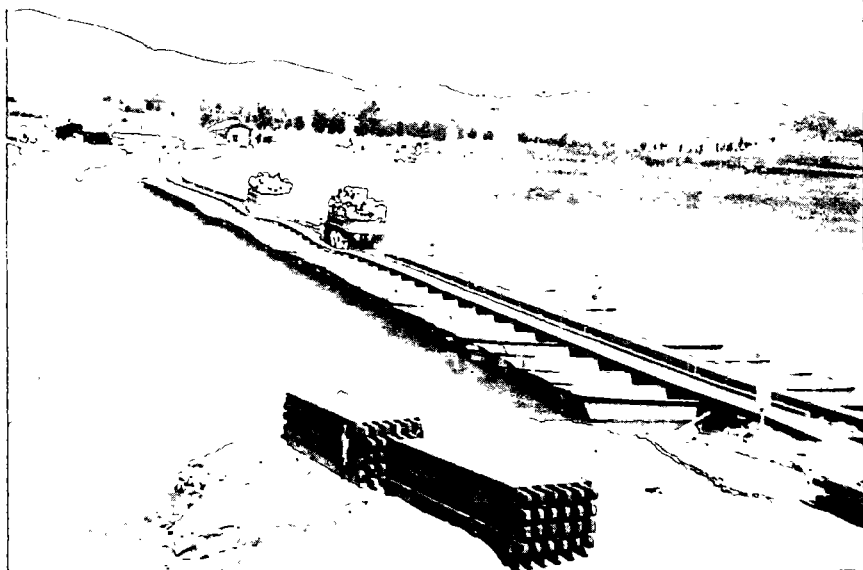


Figure 15. Ponton bridge.



Figure 16. Double underpass: a potential traffic bottle-neck.



Figure 17. Graving dock.

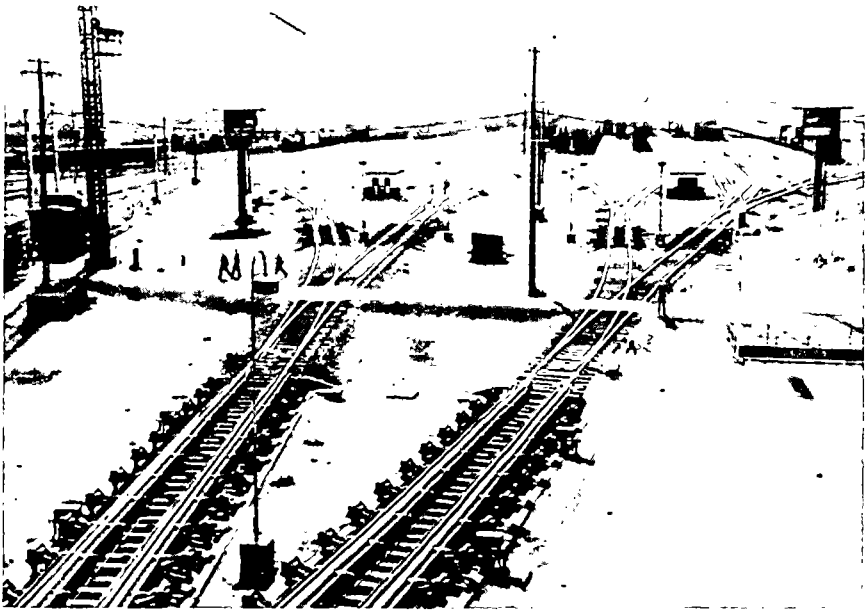


Figure 18. Classification yard, showing retarders and track layout.

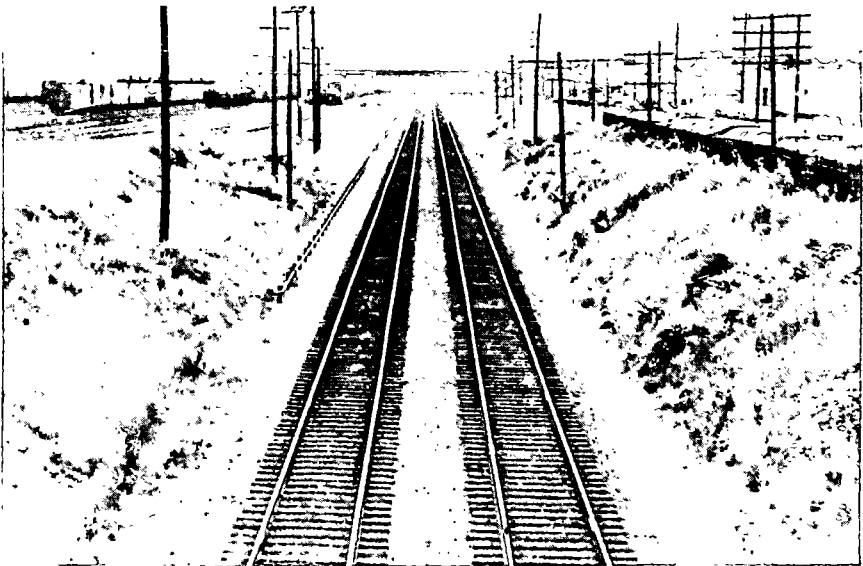


Figure 19. Section of a main line, showing right-of-way and good maintenance.



Figure 20. Close views, showing condition of rail, ties, tie plates, and ballast.

APPENDIX IX

SAMPLE INFORMATION REPORTING FORMATS

The formats shown in this appendix are suggested guides for reporting information. Because it is not possible to include all aspects of reporting on a form, extensive use should be made of the "remarks" column. If necessary, extension pages should be used to further clarify the reported information.

Figure 21. Aircraft characteristics and inventory.

(Located in back of manual)

Figure 22. Airfield characteristics.

(Located in back of manual)

WATERWAY CRAFT CENSUS - TRANSPORTATION INTELLIGENCE				NAME OF FACILITY		PREPARED BY
				Dalgo Inland Waterways System		H. B. OKES
TYPE OF CRAFT	NUMBER AVAILABLE	NAMES OF CRAFT	DISPLACEMENT (Short Tons)	MAXIMUM SPEED (Miles Per Hour)		TYPE AND POWER (HP.)
				UPSTREAM	DOWNSTREAM	
Motor barge	4	Alicia Juanita Meria J Pescado de Plata	1,200	13	16	Diesel - 1,000 hp
Ferry	3	El Capitan Monterrey Gorge I	1,000	9	12	Diesel - 325 hp
Passenger	2	La Storma Don Eduardo	350	8	14	Steam
Passenger	1	La Senora Blanca	1,500	9-11	17-16	Diesel - 1,000 hp
ADDITIONAL REMARKS Source of data - DALGO National Waterways Annual Report, Dec 1960; June 1961 operational status reports of army transportation units and G2 Interrogation Report, 13 May 1961						DATE 25 June 1961

Figure 23. Waterway craft census.

Captain, TC			HEADQUARTERS 565th Trans Team (Intel, Coll), Trans. Sec., Hqs, 7th US Army		PAGE NUMBER 3	NUMBER OF PAGES 5
					KEY	
					NA - Not Applicable	
SIZE (Feet)			CAPACITY		REMARKS	
LENGTH	BEAM	DRAFT	PASSENGER	CARGO (Short Tons)		
260'	36'	6½'	None	70-100	Capable of towing four barges	
240'	35'	6'	40	450 tons, 15-rail- way cars	Four engines: two forward, two aft. Operates between Muy Malo, La Cucaracha, and Tomasino	
160'	22'	5'	500	None	Converted motor barges	
280'	38'	7'	800	None	Operates no farther upstream than Tomasino	
TYPED NAME AND GRADE L. D. DURR, Lt Colonel, TC, Commanding					SIGNATURE <i>L. D. Durr</i>	

Figure 23—Continued.

Figure 24. Waterway physical characteristics.
(Located in back of manual)

CHARACTERISTICS OF WATERWAY LOCKS - TRANSPORTATION INTELLIGENCE				NAME OF FACILITY Santa Cristina and Puerto Del <u>Muerto Locks</u> NAME OF WATERWAY Buena Fortuna River				PREPARED BY H. C. PRICE, Caj
REFER- ENCE NO. ON MAP	LOCATION OF WATERWAY LOCKS		CONSTRUCTION	CHAMBER		ENTRANCE		TYPE AND CONSTRUCTION
	MILE STATION	NEAREST TOWN		LENGTH (Fe.)	WIDTH (Fe.)	WIDTH (Fe.)	DEPTH OVER SILL (Fe.)	
31	0.0	Santa Cristina	Reinforced concrete	145	27.7	22.7	9.5	Double-leaf miter, steel
32	36.5	Puerto Del Muerto	Masonry	136	26.3	21.3	9.0	Double-leaf miter, timber
ADDITIONAL REMARKS								

Figure 25. Characteristics of waterway locks.

Main, TC, S2		HEADQUARTERS 59th Transportation Terminal Bn		PAGE NUMBER 1	NUMBER OF PAGES 1
MILE STATION G.D. LOCATED AT OR NEAR Santa Cristina				KEY NA - Not Applicable	
POWER	LIFT (FT.)	LOCKAGE TIME (MIN.)	DATE AND SOURCE OF INFORMATION	REMARKS	
Electric	7.3	23	National Waterway Navigation Bureau Report, January 1961 and recon June 1961	Santa Cristina lock on east bank; gates need extensive repairs	
Manual	5.9	32	Do	Puerto Del Muerto lock on west bank; gates in poor condition	
			DATE 29 June 1961	TYPED NAME AND GRADE H. C. PRICE, Captain, TC, Adjutant SIGNATURE <i>H.C. Price</i>	

Figure 25—Continued.

Figure 26. Characteristics of inland waterway ports.
(Located in back of manual)

Figure 27. Vehicle characteristics and inventory.
(Located in back of manual)

ROADWAY DATA - TRANSPORTATION INTELLIGENCE				NAME OF FACILITY				PREPARED BY	
(See Footnote 1 for explanation of Roadway)				National Highway, Route 39				J. B. GAYLE, Ma.	
ROUTE NUMBER	SECTION	LOCATION (Origin and Destination)	DISTANCE (Miles)	PAVEMENT BASE				PAVEMENT	
				TYPE	WIDTH (Ft.)	THICK- NESS (In.)	CONDITION	TYPE	WIDTH (Ft.)
39A	A	Klung to Welkenburg routes 60, 70, and 89	53	Macadam	20	6	Good	Bitumen	20
39	B	Welkenburg to Prentch routes 60, 70 and 89	60	Macadam	22	8	Good	Asphalt	22
39	C	Prentch to Flaggen, route 89	92	Earth	21	9	Good	Concrete	21
39	D	Flaggen to Campfen, route 89	52						
		Mile 0 to Mile 12		Macadam	16	4	Good	Bitumen	16
		Mile 12 to Mile 42		Macadam	14	3	Fair	Crushed stone	14
		Mile 42 to Mile 52		Macadam	18	6	Good	Asphalt	18
¹ That portion of highway bounded by outside line of shoulders or inside line of curbs and ordinarily used for vehicular traffic or parking ² That portion of roadway bounded by edge of pavement surface and inside line of ditch or top of slope				ADDITIONAL REMARKS					
				DATE				TYPEO NAME AND GRADE	
				15 June 1961				J. T. BARRY, ME	

Figure 28. Roadway data.

		HEADQUARTERS				PAGE NUMBER 1	NUMBER OF PAGES 8
or, TC, Opn S3		HHC 39th Transportation Truck Bn				KEY NA - Not Applicable	
SURFACE		SHOULDERS			DATE AND SOURCE OF INFORMATION	REMARKS (Adequacy of base and drainage, bridges with restricting width and capacity, etc.)	
THICK- NESS (In.)	CONDITION	TYPE	WIDTH (Ft.)	CONDITION			
1-1½	Good	Earth	4	Good	Route recon 10 June 1961	Numerous short, shallow fords are on this section	
3	Good	Earth	4	Good	As above		
1-1½	Good	Earth	3.5	Good	Ministry of Trans- port Annual Re- port, July 1960		
1-1½	Good	Earth	5	Good	As above	Fog and frost restrict traffic in winter months (Dec-Feb)	
	Fair	Earth	3	Fair			
2	Good	Earth	4	Good		This section has a 9-inch telford subbase	
Jor, TC, Adjutant, S1					SIGNATURE <i>J. F. Barry</i>		

Figure 28—Continued.

BRIDGE DATA - TRANSPORTATION INTELLIGENCE					NAME OF FACILITY			PREPARED BY
					National Highway, Route 39			J. T. Reed
ROUTE NUMBER	SECTION	LOCATION OF BRIDGE	TYPE OF BRIDGE	OVERALL LENGTH OF BRIDGE (Ft.)	ROADWAY WIDTH (Ft.)	VERTICAL CLEARANCE ABOVE ROADWAY (Ft.)	STANDARD BRIDGE CLASSIFICATION	CLEAR HEIGHT ¹ OF SPAN UNDER BRIDGE (Ft.)
39	A	Mile 5.2 (5.2 miles N of Klung)	Concrete	330	20	Unlimited	35	25
39	A	Mile 21 (21 miles NW of Klung)	Stone masonry	400	25	Unlimited	40	20
39	B	Mile 60 (Prentch)	Steel truss and concrete T-beam	670	19.7	14.8	24	20
ADDITIONAL REMARKS								
					DATE		TYPED NAME AND TITLE	
¹ Bridge over water measured from normal water level					1 May 1961		L. D. MUI	

Figure 29. Bridge data.

Major, TC, Highway Traffic Engineer			HEADQUARTERS 41st Transportation Highway Transport Command		PAGE NUMBER 1	NUMBER OF PAGES 12
					KEY	
					NA - Not Applicable	
SPANS			DETOURS AVAILABLE	DATE AND SOURCE OF INFORMATION	REMARKS (Bridges having low capacity, horizontal or vertical restrictions, other critical features, etc.)	
NUMBER	TYPE	LENGTH (Fe.)				
7	Concrete	40' each	Stream fordable in dry weather	Route recon 1 May 1961	Over New River--deck girder bridge	
8	Stone masonry	45' each	Bridge 0.5 mile upstream	As above	Over Old River--completed in 1958--arch-type structure	
1	Steel truss	178.8'	Rail bridge 0.3 mile downstream	As above	9-span, through-truss bridge over railway lines. Carries single-track electric carline extending along middle of structure; 4.9-ft walks	
3	Concrete T-beam	51' each				
5	Concrete T-beam	57.9' each				
D GRADE				SIGNATURE		
Lt Colonel, TC, Adjutant, S1				<i>L. D. Miller</i>		

Figure 29—Continued.

TRAFFIC BOTTLENECKS - TRANSPORTATION INTELLIGENCE (Tunnels, Narrow Streets, Sharp Curves, Steep Grades, Switchbacks, Underpasses, Ferries, Fords, Etc.)					NAME OF FACILITY National Highway, Route 39		PREPARED BY C. L. POST,
ROUTE NUMBER	SECTION	LOCATION	TYPE	LENGTH (Ft)	ROADWAY WIDTH (Ft)	VERTICAL CLEARANCE (Ft)	MAXIMUM GRADE (Percent)
39	A	Mile 12.5 (12.5 miles NW of Klung)	Sharp turn		10	NA	
39	A	Mile 27 (27 miles NW of Klung)	Narrow bridge	150	10.5	Unlimited	See remarks
39	A	Mile 39 (39 miles NW of Klung)	Tunnel	4,865	16	See remarks	NA
39	B	Mile 10.5 (10.5 miles N of Welkenburg)	Series of re- verse curves and steep grades	1,000	14	NA	10
39	C	Mile 71 (71 miles NE of Prench)	Ferry	1,000	NA	NA	NA
39	D	Mile 15 to Mile 16 (15 miles N of Flag- gen)	Long grade (ascent)	7,300	14	NA	8
39	D	Mile 17 (17 miles N of Flaggen)	Mountain pass		14	NA	
39	D	Mile 46.5 to Mile 47 (46.5 miles N of Flaggen)	Flood waters	Aprx 2,500	NA	NA	NA
ADDITIONAL REMARKS							
DATE 2 July 1961				TYPED NAME AND GRADE J. T. ILES, Lt Colonel, TC, Adjutant, S1			

Figure 30. Traffic bottlenecks.

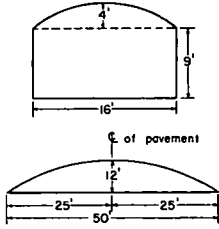
Captain, TC, Highway Regulating Officer		HEADQUARTERS 41st Transportation Highway Transport Command		PAGE NUMBER 1	NUMBER OF PAGES 3
				KEY	
				NA - Not Applicable	
MINIMUM CURVE RADIUS (FT.)	DETOURS AVAILABLE	DATE AND SOURCE OF INFORMATION	REMARKS		
See remarks	Village bypass 3 miles E	Route recon 10 June 1961	90° turn in village.		
See remarks	Ford adjacent to structure at low water	As above	East approach to bridge is on a 10 percent grade; west approach has 90° turn. Bridge class 4.		
NA		As above			
See remarks	None	Route recon 15 June 1961			
NA	None	Ministry of Transport Annual Report July 1960	Ferry service consists of two aluminum ponton boats powered by outboard motors--capacity, 3 tons (1 passenger car); crossing time, 1 to 2 hours.		
	None	As above			
	Parallel route, 30 miles west	As above	Road subject to snow blocks for 1- to 10-day periods, Dec-Feb; elev 5,500 ft.		
NA		As above	Road subject to flooding of 1 to 5 ft during heavy spring rains; water depth markers placed along each side of roadway.		
SIGNATURE <i>J. I. Mee</i>					

Figure 30—Continued.

Figure 31. Characteristics of ports and terminal facilities.
(Located in back of manual)

CHARACTERISTICS OF BEACHES AND LANDING AREAS - TRANSPORTATION INTELLIGENCE				NAME OF FACILITY Marlin Area Beaches		
BEACH NUMBER AND LOCATION	LENGTH OF BEACH		WIDTH OF BEACH		BEACH GRADIENTS	
	OVERALL LENGTH	USABLE LENGTH	LOW WATER	HIGH WATER	LOW WATER	HIGH WATER
No. 22. Centered 600 yd NE of Leander and 8.6 mi SW of Ocean View at 11°12' N, 22°22' E	2,000 yd	All usable	Aprx 30 yd	Aprx 20 yd	Aprx 1 in 30	1 in 20
No. 12 Seaview to Lakeland; centered 22°26' N, 33°36' E. On sandspit terminated on W by entrance channel into Lake Yerba	5.2 miles	4.6 miles usable	Aprx 85 yd	Aprx 50 yd	Aprx 1 in 50	1 in 50
REMARKS						
NOTES: Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations.				DATE 27 June 1961		

Figure 32. Characteristics of beaches and landing areas.

PREPARED BY J. B. MORTON, Major, TC		HEADQUARTERS 35th Trans Intel Team (Collection)		KEY NA - Not Applicable	PAGE NUMBER 3	NUMBER OF PAGES 7
APPROACH (Bottom gradients, water depths, winds, reefs, etc.)	SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	DESCRIPTION OF TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND		
Near shore bottom slopes flat; 2.4-to 4.6-ft depths 30 yd offshore; 6.8-ft depth 400 yd SW end 700 yd off SE end of beach. Approach from NW and bay generally clear over shoal depth with some rocky patches. Approach flanked on SE by small islands, reefs, and rocks, which extend for about 2 miles NW of Legborn. Bottom mud and sand; weedy close to shore.	Surf rough with prevailing northerly winds; tidal range 1.0 ft, spring tides.	Sand: soft and fine; firm only in wetted area.	Soft, sandy back-shore generally unsuitable for wheeled vehicles, backed by a sea wall and 900 yd of sand hummocks 4.6 ft high, covered with brush; all on a flat, open plain.	Across 900 yd sandy terrain by narrow one-lane road to a primary road and railroad leading to Leander.		
Near shore bottom slopes mild to flat; 6-ft depth generally 160 yd off beach except at W end where 400 yd offshore; 18-ft depth 2.0 miles offshore; approach clear over gradually shoaling sand and mud bottom; 30-ft anchorage 4.0 mile offshore E of breakwater. Bottom hard sand.	Surf rough with onshore winds; tidal range aprx 1.6 ft, spring tides.	Sand and sandstone--believed to be firm.	Low sand dunes backed by billy sandy terrain as high as 40 ft and completely covered with vegetation; terrain directly back of beach flanked on E and W by vast salt marshes.	A primary road parallels the shore about 2.0 miles inland; railroad parallels the shore 3 miles from beach. Cross-country exit across dune area to network of minor roads or trails connecting with secondary road, connecting with primary road at Hilldale.		
TYPED NAME AND GRADE B. C. DALTON, Lt Colonel, TC, Commanding			SIGNATURE <i>B. C. Dalton</i>			

Figure 32—Continued.

CHARACTERISTICS OF WHARVES TRANSPORTATION INTELLIGENCE			NAME OF FACILITY Port of Rusnak			PREPARED BY C. O. KEENE	
REFERENCE NUMBER ON PORT PLAN AND NAME OF WHARF	USE OF WHARVES	TYPE AND CONSTRUCTION	DIMENSIONS (Segments or Sides) (Feet)		DEPTH ALONGSIDE MLW (Feet)	HEIGHT OF DECK ABOVE MLW (Feet)	NUMBER AND CLASSIFICATION OF BERTHS (See Table Below)
			LENGTH	BREADTH			
7. Water Shipping Company Quay	Transfer of general cargo	Quay: reinforced concrete face; earth fill with bituminous surface	1,500	100	28	5	3 B
11. XYZ Petroleum Pier	Receipt of petroleum products	T-head pier: timber deck on wood piles; approach 20'x275'; T-head 25'x75'. Three dolphins, aligned with face, spaced 50' apart on each side of T-head	75	25	25	7	1 T-C
REMARKS (Dimensions, capacity limiting factors, etc.)							
7. All transit sheds are 1-story, 50'x200' brick buildings equally spaced along quay. Entrance N transit shed to be replaced by 2-story 75'x250' reinforced concrete building in October 1961.							
11. Pier serves XYZ Company tank farm of 21 tanks, each 40' in diameter and 50' high (capacity, each 11,000 bbl), 500 yd directly behind root of pier.							

Figure 33. Characteristics of wharves.

		HEADQUARTERS		PAGE NUMBER 3	NUMBER OF PAGES 5
Capt'n, TC, S2		520th Transportation Terminal Bn		KEY NA - Not Applicable	
MECHANICAL HANDLING FACILITIES (Conveyors, Trucks, etc.)	APRON (Ft.)	COVERED TRANSIT OR STORAGE		CLEARANCE (Rail and Road Connection)	UTILITIES
		NUMBER OF BUILDINGS	GROSS FLOOR AREA (Sq Ft)		
Six 6-ton and one 15-ton traveling electric portal cranes	55	6	60,000	Rail: single flush track along quay face; one additional track behind transit shed. Road: truck access to quay- side.	Water: by quay hydrant at 10 tons per hour. Electricity: quay poorly lighted; power available to vessels.
One 1½-ton fixed electric jib crane. One 8-in. pipeline for discharge of gasoline; one 6-in for discharge of fuel oil	Open	1	NA	Rail: none. Road: limited truck access to shipside.	Water: none. Electricity: pier poorly lighted.
CLASSIFICATION OF BERTHS				TYPED NAME AND GRADE	
GENERAL			TANKER		
CLASS	BERTH DIMENSIONS (Ft.)		CLASS	BERTH DIMENSIONS (Ft.)	
	LENGTH	DEPTH		LENGTH	DEPTH
A	383	31-30	T-A	800	34
B	460	29-23	T-B	828	31
C	330	23-18	T-C	480	26
D	330	17	T-D	530	14
E	200	13			
F	100	7			
				SIGNATURE <i>C. D. Keene</i>	
				DATE 21 June 1961	

Figure 33—Continued.

CRANE CHARACTERISTICS AND INVENTORY - TRANSPORTATION INTELLIGENCE						NAME OF FACILITY Port of Blesade		PREPARED BY H. C. MILES, C.			
NUMBER AND TYPE OF CRANES	TYPE OF POWER	LIFT (Tons)	DIMENSIONS				SPEEDS (Per Minute)				
			RADIUS		OUT REACH BEYOND WHARF FACE	HOIST		LIFTING	LUFFING	SLEWING (Revolu- tions)	TRAVELING
			MAXIMUM	MINIMUM		ABOVE WHARF	BELOW WHARF				
ASHORE:											
5 portal jib cranes	Electric	5 1.5	NA 55'	30' NA	41.5' NA	60' NA	36' NA	120' 180'	200'	1.5	40'
2 locomotive cranes	Steam	6 3	NA 26'	13' NA	20.0' NA	31' 26'	26'	200'	250'	3	300'
1 gentry crane	Electric	10	NA	NA	NA	16'	NA	250'	NA	NA	250'
2 mobile jib cranes	Gasoline	5	30'	15'	NA	40'	NA	185'	220'	5	20 mph
AFLOAT:											
1 floating jib crane (self- propelled)	Steam	25 10	NA 75'	55' NA	NA	60'	NA	32.3'	30'	.7	NA
1 floating crane	Steam	10	Fixed at 23' from edge of pontoon		NA	25'	NA	28'	20'	NA	NA
ADDITIONAL REMARKS 4 bridge transporters (electric) available ashore. Dimensions of each: Span (overall) 287'; cantilever (over trolley travel--speed 200'/min, along bridge 187', along cantilever 80', outreach from wharf face 50.5'; hoist- handling capacity 60 tons/hr.											

Figure 34. Crane characteristics and inventory.

Main, TC	HEADQUARTERS 904th Trans Team (Intel, Collection) Trans Sec, Hqs 3d Corps, 1st Army				KEY NA - Not Applicable		PAGE NUMBER 1	NUMBER OF PAGES 1
	PORTAL CLEARANCE		TRACK		NAME	CONDITION	LOCATION	REMARKS
BASIC MOTIONS	HEIGHT	WIDTH	LENGTH	GAGE				
Slewing (360°), luffing, hoisting traveling	13'	14'	425'	15'	Applevega	Fair	South Quay, New Sasin	Serves Berth No. 1 Use: General cargo
Slewing (360°), luffing, hoisting traveling	NA	NA	840'	105 cm	Levquen	Fair	South Quay, New Sasin	Serves all berths Use: All-purpose
Hoisting, travel- ing, reeking	18'	28'	200'	29.5'	Drevo	Good	Rehandling area south of South Quay	Use: Rehandling general cargo
Slewing (360°) luffing, hoisting traveling	NA	NA	NA	NA	Acro	Excellent	Lighter wharf	Use: All-purpose
Slewing (360°), luffing, hoisting	NA	NA	NA	NA	Craven	Poor, limited to 15 tons	NA	Hull: 48' by 110' Draft: fwd--3' aft--5.3'
Luffing, hoisting	NA	NA	NA	NA	Butler		NA	Hull: 40' by 90' Draft: fwd--1.2' aft--2.0'
berth 100'; grab capacity, 2 tons; above wharf 60.7', below wharf 28',				DATE 13 June 1961		TYPED NAME AND GRADE B. T. PARKER, Major, TC, Commanding SIGNATURE <i>B. T. Parker</i>		

Figure 34—Continued.

Figure 35. Warehouse data.
(Located in back of manual)

Figure 36. Railroad line characteristics and facilities.
(Located in back of manual)

Figure 37. Locomotive characteristics and inventory.
(Located in back of manual)

FREIGHT EQUIPMENT CHARACTERISTICS AND INVENTORY - TRANSPORTATION INTELLIGENCE						NAME OF FACILITY		
						Shiloh National Railways		
TYPE OF EQUIPMENT (Box, Gondola, Flat, etc.)	CLASS OR SERIES (Letter or Number Designation)	NUMBER IN SERVICE	YEAR BUILT	CAPACITY (Short Tons)	TARE WEIGHT	INSIDE DIMENSIONS (Ft. and In.)		
						LENGTH	WIDTH	HEIGHT
Box, steel*	XM	2584	1925	50	22 STON	40' 6"	9' 2"	10' 6"
Hopper, steel	HT	3157	1930	70	25 STON	40' 2"	9' 6"	NA
Gondola, steel	GB	1600	1932	70	20 STON	46' 0"	9' 6"	3' 0"
Flat, steel	FM	602	1934	95	35 STON	30' 0"	9' 0"	NA
REMARKS								
*Boxcar door opening: 8' wide and 9' 10" high								

Figure 38. Freight equipment characteristics and inventory.

PREPARED BY			HEADQUARTERS			PAGE NUMBER 2	NUMBER OF PAGES 3	
H. 8. COATS, Lt Colonel, TC, S2			799th Transportation Railway Group			KEY NA - Not Applicable		
OUTSIDE DIMENSIONS (Ft. and In.)			FLOOR HEIGHT ABOVE RAIL (Ft. & In.)	NUMBER OF AXLES	TYPE OF BRAKES	COUPLER		LENGTH BETWEEN BUFFERS (Ft. & In.)
LENGTH	WIDTH	HEIGHT				TYPE	HEIGHT ABOVE RAIL	
42' 3"	10' 8"	15' 2"	3' 5 3/4"	4	Air	AAR standard E.	2' 10 1/2"	NA
42' 0"	11' 3"	11' 4"	3' 5 1/2"	4	Air	Do	2' 10 1/2"	NA
48' 7"	10' 4"	7' 4"	3' 5 1/8"	4	Air	Do	2' 10 1/2"	NA
30' 0"	10' 0"	7' 1"	3' 5 1/8"	4	Air	Do	2' 10 1/2"	NA
			DATE	TYPED NAME AND GRADE				
				M. L. KEYES, Major, TC, Adjutant				
			15 June 1961	SIGNATURE <i>M. L. Keyes</i>				

Figure 38—Continued.

APPENDIX X

DEFINITIONS OF TERMS

It is imperative that transportation personnel understand the terms used in reporting transportation information and intelligence. They must also know the technical terms used to describe the capabilities and capacities of the various modes of transportation. Use of standard terms will result in analogous reports and facilitate logistical planning. Frequently used general terms are defined in paragraph 1; terms peculiar to transportation are defined by modes in subsequent paragraphs. See AR 320-5 for additional terms used in reporting information and intelligence.

General

Intelligence:

activity:

Clandestine—Activity that is secret by design.

Overt—Activity that is open: no secrecy is required.

Combat—Knowledge of the enemy, the weather, and the geographic features that are used in the planning and conduct of tactical operations within a given area.

Counterintelligence measures:

Active—An attempt to thwart the enemy's attempts to gain information or to engage in sabotage or subversion. It includes deception and misleading of the enemy.

Passive—Defensive measures to conceal information or intelligence from the enemy.

Estimate—An appraisal of the elements of intelligence relating to a specific situation or condition with a view to determining the courses of action open to the enemy or potential enemy.

Interception of—The act of listening in on and/or recording communications intended for another party to obtain intelligence.

Security—Preservation of secrecy concerning all phases of intelligence activities. It is counterintelligence within the intelligence service.

Tons:

units of volume:

Measurement—Measure of cubic volume of cargo, expressed

in units of 40 cubic feet. It is used to indicate the cubic capacity of a vessel available for cargo. Also known as ship ton.

Register—100 cubic feet.

units of weight:

Long—2,240 pounds.

Metric—2,205 pounds (1,000 kilograms).

Short—2,000 pounds.

Aviation

A-N (or AN) codes—Codes established to identify parts and materials which are included in the specifications established by the U. S. Army and U. S. Navy. The AN is followed by numbers, which identify or classify the part, and the numbers are in turn followed by code letters which define the part's chief mechanical properties, its heat-treated condition, requirements for use, and its dimensions. Use of an AN code system is accepted as standard; the system is used by commercial aircraft manufacturers.

Absolute ceiling—The maximum height above sea level at which a given airplane is able to maintain horizontal flight under standard air conditions.

Adjustable-pitch propeller—A propeller so constructed that its blade angle may be adjusted manually on the ground while the propeller is standing still. Also called an adjustable propeller.

Aileron—A hinged or movable portion of an airplane wing; its primary function is to impress a rolling motion on the airplane. It is usually part of the trailing edge of a wing and produces roll about the longitudinal axis of the plane.

Air delivery—A method of air movement which permits personnel, supplies, and equipment to be unloaded from aircraft while in flight.

Aircraft balance limits—The maximum forward and maximum aft permissible locations of the aircraft center of gravity expressed as station numbers or as percentages of the mean aerodynamic chord (MAC). If these limits are exceeded, the aircraft will have unsatisfactory flight characteristics.

Air evacuation—Removal of personnel or materiel or both by air.

Airspeed—The speed of an aircraft relative to the air through which it moves; it is entirely independent of any distance covered on the surface of the earth.

Applied load (lashing term)—The total stress or load imposed upon one cargo tiedown fitting. The applied load equals the

tensile strength of all the cargo tiedown devices attached to one cargo tiedown fitting.

Autogyro—An aircraft employing the use of a nonpowered overhead rotor for lift and conventional propellers and engines or engines for forward thrust.

Autorotation—The process of producing lift with airfoils that freely rotate because of aerodynamic forces resulting from a flow of air through the system.

Boundary layer control—A means of decreasing stall speed by the intake or exhaust of air over the surface of an airfoil.

Cargo compartment—That interior portion of the aircraft especially designed to carry cargo or passengers.

Cargo tiedown devices—Ropes, cables, chains, webbing, and other lashing materials which are used to secure cargo to tiedown fittings to prevent shifting of load.

Cargo tiedown pattern—The location and spacing of the cargo tiedown fittings in the floor, ceiling, or walls of an aircraft.

Center of gravity—The point about which an object would balance if supported at that point; or the point at which the weight of an object or group of objects can be considered concentrated.

Chord—An imaginary line connecting the leading and trailing edges of an airfoil.

Controllable-pitch propeller—A variable-pitch propeller so constructed that its blade angle may be changed to either one of two angles by the pilot from the cockpit while the propeller is rotating. Also called a controllable propeller.

Convertiplane—Aircraft capable of vertical flight and of normal forward flight.

Departure point—A location on the ground used to mark the transition from overland to overwater flight procedure, or from flight procedure used over friendly territory to that used over enemy territory.

Drop site—Specified area where external cargo carried by helicopter may be released.

Flap chords—An imaginary line connecting the leading and trailing edges of a flap.

Flaps—A device to increase the lift of an airfoil.

Ground cushion—The high pressure region between the helicopter and the ground that is produced by the downwash of the rotor blade is called the ground cushion. This ground cushion helps to support the helicopter while hovering; it is effective to a height of approximately one half the rotor diameter.

Ground effect—The favorable effect gained by using the additional lift provided by the ground cushion.

Helicopter—A type of rotor plane whose support in the air is normally derived from airfoils mechanically rotated about an approximately vertical axis.

Hover ceiling out of ground effect—The altitude above sea level which a helicopter can maintain at zero airspeed out of ground effect.

Jet engine—A thermodynamic engine which generates thrust by expelling gases. Usually some form of a turbine.

Landing:

Gear—The understructure which supports the weight of an aircraft when in contact with the land or water and which usually contains a mechanism for reducing the shock of landing. It includes the main landing wheels, tail wheel, nose wheel or tail skid, etc.

Site—Designated point or defined area within a larger specific area used for landing or takeoff of rotary-wing aircraft.

Zone—Specified zone within an objective area used for the landing of aircraft.

Load spreader—Wooden planks or similar material placed on the cargo compartment flooring of an aircraft to distribute the load reactions of the cargo over a greater area and reduce the floor bearing pressure.

Navigational aids—Aids to navigation, such as isogonic lines, compass roses, airfields, beacons and direction finders, major radio stations, and emergency landing fields.

Passenger capacity—The number of seats in an aircraft for persons other than the operating crew.

Pickup site—A specified area where a helicopter may pick up an external cargo without landing. Physical restrictions may be such that the craft cannot land but still may be capable of picking up an external load.

Point of no return—A critical point reached on a flight course when an aircraft with no possibility of landing at an intermediate base can no longer return to its own or some other associated base on its own fuel supply.

Power loading—The aircraft weight divided by takeoff horsepower.

Propeller pitch—Angle at which propeller bites into the air; distance the propeller travels in one revolution.

Propeller reduction—The relationship between engine revolutions per minute and propeller revolutions per minute.

Radio equipment—That equipment installed or carried in an aircraft which is required for communication with other aircraft or ground stations. Radio equipment is also used as a navigational aid.

Rated strength of lashing—The safe-load capacity of a cargo tiedown fitting or lashing with an applied safety factor. In many cases, the rated strength of a cargo tiedown fitting is restricted by the angle of application to the load.

Reference datum line—An imaginary vertical line at or near the nose of the aircraft from which all horizontal distances are measured. Aircraft diagrams show this line as structural station zero.

Rotary-wing aircraft—This term encompasses the entire field of aircraft which obtain lift by means of a rotating airfoil; that is, the autogyro, the helicopter, and the convertiplane.

Rotor—The complete rotating portion of a rotary-wing system.

Rotor disc area—Area swept by a rotor or rotors.

Spoiler—A surface protruding from the fuselage or wings of an aircraft for the purpose of disturbing the otherwise smooth flow of air over this surface.

Standard atmosphere—The atmospheric condition at sea level which has a temperature of 15° C and a barometric pressure of 29.92 inches of mercury.

Stub wing stabilizer—A projection from the side of the central hull of a flying boat intended to increase its buoyancy and stability while the boat is at rest and to increase the hydrodynamic lift during takeoff. It is an integral part of the hull and usually takes the form of a stumpy airfoil or stub wing.

Taper ratio—The relationship of wing tip chord to wing root chord.

Turboprop engine—A gas turbine engine which drives propeller(s) or rotor(s).

Useful load—The weight of the gas, oil, crew, passengers, baggage, and/or cargo.

User air delivery—Delivery of supplies by air directly to the using unit rather than to a depot or other distributing agency.

Variable-pitch propeller—Any propeller that can have its blade angle changed while rotating.

Vectoring aircraft—The directional control of inflight aircraft through transmission of azimuth headings.

V_{max}—Maximum safe airspeed at which aircraft may operate under given conditions.

Weight:

Basic—The weight of the aircraft including its operating equipment, but excluding crew, oil, fuel, and cargo.

Basic operating—Basic weight of the aircraft plus minimum crew, but excluding fuel and cargo.

Empty—The weight of the aircraft with all its necessary parts, not including useful load.

Maximum (alternate) gross—A gross weight in excess of the design gross weight. The maximum alternate gross weight is normally used in combat operations, but does not afford any margin of safety.

Normal (design) gross—The gross weight on which the aircraft design is based. It is the maximum weight at which the aircraft can be flown and still meet the load and safety factors established by design specifications.

Ready-for-loading—Total aircraft, crew, oil and fuel weight; or the gross weight less cargo; or the basic weight plus crew, oil, and fuel.

Wing loading—Airborne weight divided by wing area.

Inland Waterway

Bridge:

Bascule—Span moves in vertical plane, either rotating about horizontal axis or rolling back from opening.

Lift—Span is raised vertically to a sufficient height to allow vessels to pass underneath.

Retractable—Span is supported on wheels resting on tracks on the shore. Wheels are rolled backward from the opening either along the approach of the bridge or at an angle.

Swing—Span revolves horizontally about a vertical axis, which may be at the center, at one end, or at an intermediate point of the span.

Canal—Artificial waterway used for navigation, drainage of low land, or irrigation.

Chamber—A British term for a small basin, usually having a small entrance located inside a harbor, used for berthing small craft.

Current velocity—Rate at which water in a stream moves, usually expressed in knots; however, it may be expressed in feet per second or in centimeters per second.

Dredge:

Dipper—A dredge whose principal components are a bucket,

boom, and cable. It digs with a scooping motion along the bottom.

Elevator—This type of dredge is composed of many scooping buckets mounted on a continuous ladder or elevator.

Grapple—A derrick mounted on a float and swinging a grab bucket, such as a clamshell.

Hydraulic—This type draws a mixture of water and solid material from the bottom into a suction pipe and forces the mixture through a discharge pipe to the disposal area.

Feedwater stream—Stream supplying water to a navigable waterway.

Levee—Embankment to prevent inundation or to control the area to be flooded.

Lock—Inclosure in canal, river, lake, or dock, with gates at each end, used to raise or lower vessels as they pass from one water level to another.

Lock time—Time taken for a craft and its tow to transit a lock.

Rip-rap—Protective work on sloping bank of river or canal, generally consisting of stones or brick.

Safe draft—Maximum, practical vessel draft for the waterway. This is normally from $\frac{1}{2}$ foot to 2 feet less than the controlling depth, depending on the nature of the waterway and the type of craft.

Shiplift—A lock in which the vessel is lifted in a watertight trough rather than by raising level of water in chamber as is done in a conventional lock. A shiplift is used where the lift requirement is very great. Counterbalances or other devices are used to balance weight of trough and vessel.

Silt—Fine granular material composed of particles .002 inches or smaller in diameter. (Silt when wet lacks plasticity and when dry has little strength.)

Sluice—Gate of spillway for draining excess water from channel.

Tandem lock—A lock installation consisting of two or more chambers in series: locking is accomplished in two or more steps. Intermediate gates are common so that three gates (instead of four) are sufficient for a two-step tandem lock.

Tidal bore—Tidal wave which regularly or occasionally rushes into a river, presenting a very abrupt front of considerable height.

Tidal gates—Double pair of gates at end of lock in tidal regions with apexes facing in opposite direction. Either pair may be used, depending on which side of lock has the higher water elevation at the time.

Training wall—Similar in construction to a jetty; it is used to direct flow of river current to stabilize and deepen channel as well as to prevent erosion of river banks. A training wall is usually alined parallel with channel and direction of waterflow.

Turnaround time—The sum of navigating time, time in ports, and time in locks.

Watershed—1. The boundary ridge between one drainage area and another. 2. The whole region or area feeding a river or other body of water. Watersheds are sometimes called “catchment areas” or “watershed basins.”

Motor Transport

A-frame—Mechanical maneuvering device in the form of the letter A used to lift vehicles or other cumbersome objects. May be either in a stationary position or mounted on a vehicle.

Base course—The material between the surface course and the subgrade.

Berm—(See Shoulder.)

Bridge:

Abutment—The ground support at the end of a bridge. It may consist of a concrete or masonry abutment, pile bent, or crib-type support with the necessary backwall or end dam.

Fixed—Bridges that cannot be transported from place to place. This category includes movable bridges; that is, spans that can be moved from normal position to allow passage of vessels.

Footing—That part of any bridge support which rests directly on the ground. It distributes the load over an area large enough to keep the support from sinking into the ground.

Load:

Dead—Weight of a bridge itself.

Impact—The added burden that results from the movement of live loads, such as the bouncing effect of wheels on an uneven bridge surface, the acceleration and braking of vehicles, and the marching of troops.

Live—The weight of anything that moves on the bridge—for example, troops, vehicles, animals.

Pier—Intermediate support of bridge; requires no external bracing for stability.

Transportable—Bridges that can be transported from place to place.

Crib—A type of wall or understructure consisting of wooden framework filled with stone.

Crown—The difference in elevation between the center of the roadbed and its edges; it is expressed in inches.

End dam—A wall of planks at the end of a bridge to keep the approach road from caving in.

Fording depth—Depth of water through which vehicles may be successfully operated at slowest speed.

Foundation—The ground over which a road is built. It may be the natural ground or it may be fill material plus natural ground.

Gradeability—The steepest slope, measured in percent, that a vehicle will traverse with transmission in lowest forward gear and transfer case or auxiliary transmission in low range.

Ground clearance—Minimum clearance under lowest point of chassis.

Highway:

Capability—The maximum number of short tons of payload per day which can be moved over a highway. (This capability is affected by type of roadway, maintenance, hills, curves, weather, other traffic, types of vehicles used, and other limiting factors.)

Capacity:

Basic—The maximum number of vehicles that can pass over a highway during a 24-hour period based upon type of vehicle, type of pavement, and vehicle-operating speed and interval.

Operational—The maximum number of vehicles that can pass over a highway, in a 24-hour period, derived from estimates of basic capacity by making allowance for driver characteristics and unforeseen operational development, vehicle casualties, changing drivers, and essential vehicle preventive maintenance on the route.

Practical daily—The maximum number of vehicles that can pass over a highway per day as determined by highway characteristics and operating conditions.

Net weight—Weight of fully equipped vehicle in operating condition with fuel, lubricants, and water, but without crew or payload.

Pavement:

Flexible or nonrigid—Consists of gravel, crushed stone, or bituminous mixtures.

Rigid—Consists of portland cement concrete slabs. May be constructed directly upon the subgrade or upon a base course.

Pile bent—An intermediate support for a bridge consisting of a row of piles capped by a braced horizontal member.

- Shoulder**—The portion of the roadbed between the traffic lane and the ditch or fill slope.
- Slope percent**—Ratio between the vertical rise and the horizontal distance traveled.
- Stringers**—Longitudinal members resting on and spanning the distance between transverse supports (transoms), intermediate supports, or abutments.
- Subgrade**—The compacted upper 6 to 12 inches of road foundation. It may be in a natural state.
- Superstructure**—The complete upper portion of a bridge which rests on piers and abutments.
- Surface or wearing course**—Top layer or material which the vehicles contact directly.
- Surface types:**
- aggregate:**
- Cement concrete**—A high type surface made of gravel, sand, and cement.
- Crushed stone**—Aggregate crushed to correct size from large stones.
- Gravel**—Aggregate produced by nature. Generally a binder, such as clay, is used because of the roundness of particles.
- Macadam**—Broken or crushed stone, with stone screenings and sand. May be bound with water or by traffic.
- Bituminous**—Principal binder is asphalt or tar.
- Concrete**—High type surface composed of a mixture of asphalt cement and mineral aggregates prepared in a plant and laid either hot or cold. Generally placed with asphalt paving machines.
- Mix-in-place**—Mixture of aggregates and liquid bituminous material mixed directly on the road base by using blade graders, road drags, etc.
- Penetration macadam**—Constructed by spreading and compacting course, uniform rock fragments bound together by aggregate interlock and surface applications of hot asphalt cement or road tar.
- Surface treatment**—A thin wearing surface of one or more applications of bituminous material and aggregate spreadings.
- Block and brick**—Blocks or bricks usually laid on a cushion of fine sand over a macadam or concrete base.
- Asphalt block**—Fine, dense, asphaltic concrete compressed into blocks.
- Brick**—Pavement constructed from special, hard bricks produced from shale.

Stone block—Pavement made from stone blocks, about the size of paving brick. Surface of pavement is slightly rounded.

Low-type—Surface in which natural soil or selected soils are used separately or in combination.

Earth—Surface of natural soil.

Laterite—Surface constructed of decayed rock with high content of iron oxides. This surface is usually red in color and is slippery when wet.

Primitive—Roads or trails which follow the contour of the ground.

Turning radius—Radius of smallest circle within which vehicle can make a complete turn.

Well-graded material—Material containing all sizes of particles from coarse to fine.

Port, Beach, and Landing Area

Basin—An artificially inclosed body of water which forms a harbor or part of a harbor.

Berth—A position for a vessel to secure either at a wharf, at moorings, or at anchor.

Breaker—Wave with broken or breaking crest.

Breakwater—Artificial barrier designed to break force of sea and to furnish shelter on shoreward side.

Buoy, mooring—Buoy especially designed and anchored for vessels to tie up to. Mooring buoys are frequently arranged in pairs, one forward and one aft to provide fixed moorings.

Caisson—A watertight, hollow box or cylinder of concrete, metal, or wood that is sunk under water deep enough to secure a good foundation and then filled with masonry, concrete, or other material. Precast concrete caissons are sunk in line to form a quay wall, filled with concrete or rubble, and then capped with a reinforced decking.

Capacity:

Anchorage—Determined by the number and size of free-swinging anchorage berths. Berths vary in size according to the size of the vessel and depth of water.

Cubic bale—The space available for leading cargo measured in cubic feet to the inside of the cargo battens on the frames and to the underside of the beams. This measurement is used to compute the space available for general cargo.

Throughput—Total tonnage that can be received, unloaded, and cleared through a terminal in any one day.

Crane :

Floating—A crane that is mounted on a ponton or barge.

Gantry—A large, heavy cargo crane which moves along a wharf on tracks.

Jib—Basic type of crane consisting of upright structure on which an arm (jib) is mounted so as to extend at an angle. The end of the jib has sheaves from which a load may be suspended.

Luffing of—Altering the angle of the jib that carries the hoisting rope to change the radius for raising or lowering a load. (Level-luffing cranes are fitted with compensating gear to enable a suspended load to be maintained at a constant height while luffing is in progress, using less power than otherwise would be necessary.)

Slewing of—Rotation of a jib about a vertical axis.

Dock :

Graving—A basin into which a ship is floated for cleaning and repairs. It is fitted with gates or caissons which, when closed, permit the dock to be pumped dry, leaving the vessel resting on keel blocks.

Wet—An artificial basin in which water is retained by caissons or gates and kept at a certain level so that ships always remain afloat regardless of the level of water outside the dock. Entrance is usually through a lock.

Dolphin—Usually, a cluster of piles placed in the water for mooring vessels or for keeping them away from structures, shoals, or shore.

Finger pier—A small, narrow pier, usually built in parallel series, used for berthing small vessels, particularly submarines and other naval craft.

Freeboard—The vertical distance measured on the vessel's side amidships from the load waterline to the upper side of the freeboard deck or a point corresponding to it.

Harbor—An area of water affording natural or artificial haven for ships. A harbor is a port only when used for cargo transfer or other business between ship and shore.

Harbor protective works—Engineering structures designed to provide shelter, control water flow, regulate erosion, and improve navigability. Principal categories are breakwaters, jetties, bulkheads, basins, docks, maintained channels, dikes, and moles.

High water (HW)—The maximum height reach by a rising tide. The height may be caused solely by the periodic tidal forces or it may have superimposed upon it the effects of prevailing meteorological conditions.

Hinterland—The natural area behind the coast, remote from urban areas.

Jetty—A structure extending out from shore to control or divert currents or to protect the harbor. In British terminology, landing piers and wharves are jetties.

Jib boom—A spar or boom which serves as an extension of the bowsprit. That part of a crane which extends the horizontal lifting distance.

Keel line—The line of the fore and aft member running along the centerline of the ship at its lowest part.

Landing stage—1. Moored floating platform connected with shore by adjustable gangway; used as a landing for small craft. 2. A raised platform designed to receive gangplank of a ship riding high in the water.

Lighter—A small vessel used to load or discharge cargo from larger ships.

Lighterage—The use and operation of lighters.

Loading trestle—A wharf upon which is built an elevated trestle used for the gravity loading of bulk commodities to vessels berthed alongside. The trestle may be fitted with a conveyor belt or with tracks which accommodate railroad cars with bottom doors.

Low water (LW)—The minimum height reached by a falling tide.

Marginal wharf—Wharf structure built against and parallel to shoreline. Berthing space is available only at face. This type of wharf is generally of open construction with wooden, concrete, or steel piling and a wooden or concrete deck.

Mole—A massive structure of masonry or large stone used as a breakwater.

Pier head line—An established harbor line marking the permissible limit of pier construction.

Quay wall—A wall along the shore used to retain earth. It may or may not be used as a wharf. When used as a wharf, it is called a quay.

Reconnaissance, hydrographic—Reconnaissance of an area of water to determine depths, beach gradients, the nature of the bottom, and the location of coral reefs, rocks, shoals, and man-made obstacles.

Roadstead—An open anchorage with little or no protection.

Slip—The area between two piers. It may or may not be a dock.

Stiff ship—A ship is said to be "stiff" when it has excessive weight

in the lower hold and insufficient weight in the 'tween decks. A stiff ship has a tendency to snap back from a roll in a sudden, jarring manner.

Tender ship—A vessel with excessive weight in the 'tween decks and insufficient weight in the lower hold. A tender ship has a long, slow roll and a tendency to capsize.

Tides—Variation in water levels caused by the combined gravitational effects of the sun and moon.

Neap—When the sun and moon are in quadrature with the earth, their influences partially counteract each other and neap tides occur. The average height of the high waters at the times of neap tides is called "mean high water neaps," and the average height of the corresponding low waters is called "mean low water neaps."

Spring—Tides occurring at new moon and full moon. (The word "springs" has no reference to the season: both a new moon and a full moon occur once in every lunar month.) Spring tides have the greatest range. The average height of the high waters of the spring tides is called "spring high water" or "mean high water springs," and the average height of the corresponding low waters is called "spring low water" or "mean low water springs."

Transit shed—A building on a wharf which provides temporary accommodation and sorting space for cargo being transferred to or from a vessel.

Wharf—A structure that provides alongside berthing for vessels discharging cargo.

Wharf apron—The portion of the wharf deck that lies between the outer edge of the wharf and the transit shed.

Railroad

Ballast—Selected materials (usually crushed rock that is irregular in shape, easily tamped, fireproof, well-drained, resistant to plant growth, and evenly distributed) placed on the roadbed to hold the track in proper alignment.

Block—A length of track of defined limits, the use of which by trains is governed by block signals, cab signals, or both.

Car retarder—Braking device, usually power-operated, built into track to reduce speed of cars by means of brakeshoes. When set in braking position, brakeshoes press against wheel flanges.

Carrier—Individual or company operating a commercial transpor-

- tation service. Classified as common carrier if serving the public; otherwise classified as private or contract carrier.
- Centralized traffic control*—System of railroad operation which uses a centrally controlled signal system to direct traffic over entire route.
- Clearances*—A specified distance measured horizontally from the center line of a track and vertically from the top of rail to fixed objects adjacent to and above the track.
- Coupler*—Appliance for connecting or coupling tenders to cars, cars to cars, locomotives to cars, or for coupling other rail equipment.
- Crossover*—Scheme of switches, frogs, and rails attached to two adjacent or parallel tracks to permit continuous movement in either direction from one track to the other.
- Curve resistance*—The resistance offered at the drawbar to motion along a curved track over and above that offered by a straight track. (For military railway planning figures, the curve resistance is converted to and expressed in terms of grade resistance.)
- Departure yard*—Yard in which cars are assembled in trains for forwarding.
- Drawbar*—(See Coupler.)
- Enginehouse*—Building in which locomotives are kept and/or serviced between runs. Enginehouses generally have some maintenance and repair facilities.
- Engine terminal*—Includes engine storage, shelter, and repair facilities; coaling station; cinder pit; and water and oil stations.
- Frog*—Track structure used at the intersection of two running rails to provide support for wheels and passageway for wheel flanges, thus permitting wheels on either rail to cross the other.
- Grade resistance*—Resistance to the progress of a train caused by an incline: gravity tends to pull the train downhill.
- Gross trailing load*—The maximum total weight or load a locomotive can pull.
- Guard rail*—Rail or other type of bar laid parallel to running rails of track to hold wheels in correct alignment and prevent wheel flanges from striking the points of crossing frogs and switches.
- Length of line*—The mileage of the right-of-way which makes up an operating railroad between defined locations. A railroad line may have one, two, three, or four tracks; it may include sidings, spurs, and yard tracks.

Locomotive—The prime mover used on railroads. Locomotive are classed according to power as electric, diesel-electric, diesel-mechanical, and steam. They are classed according to use as freight, passenger, and switch.

Main track—A track, extending through yards and between stations, upon which trains are operated by timetable or train order or both, or the use of which is governed by block signals.

Marshaling yard—(See Yard.)

Net train load—The actual weight of the commodities carried in the cars of a train.

Passing track—Auxiliary to main track, connected at both ends to the main track, used for meeting or passing trains.

Profile—1. A drawing of a longitudinal section of a track that shows elevation and depression. 2. A drawing showing grade line of a railroad, usually obtained from levels taken from the top of the rail. 3. A drawing that shows location and character of structures and the location and amount of curvature.

Rack railway—Type of mountain railway which has a cogged rail, fastened between the regular track rails, that fits the cogwheels of locomotives. Purpose of cogs is to give maximum wheel traction when adhesive weight of locomotive is insufficient because of the grade.

Rail fastenings—Splice bars (also called joint bars), bolts, and spikes. Splice bars, joined together by bolts and boltsecuring devices, are the main parts of the rail joint.

Railway-track scale—Scale especially designed for weighing railroad equipment.

Receiving yard—(See Yard.)

Relay yard—A yard that is used to receive, service, and forward through trains, keeping each train intact.

Right-of-way—Land or water rights necessary for the roadbed and its accessories.

Roadbed—The finished surface of roadway upon which track and ballast rest.

Rolling stock—Rolling rail equipment that is pulled by a locomotive; for example, boxcars, flatcars, tank cars, and refrigerator cars.

Roundhouse—Same as enginehouse except roundhouse has stalls and a turntable.

Ruling curvature—Any curve which, because of its degree of curvature and maximum safe superelevation, limits the average speed of trains over a division or length of line.

Ruling grade—The grade on a division or length of line which limits the tonnage a locomotive may haul. The ruling grade is expressed as a percent. Rate of grade is the inclination of the track from the horizontal; that is, the vertical rise in feet divided by the horizontal distance expressed in 100-foot stations.

Running rail—The rail or surface on which the wheel bears as distinguished from a wing rail or guard rail.

Serving railroad—A common carrier whose tracks are connected to Government-owned tracks for delivery or receipt of freight.

Side track or siding—Auxiliary to main track used for other purposes than for meeting and passing trains.

Snowshed—Roofed structure built over tracks to prevent snow blockades. Used in locations where snow cannot be handled with plows; e.g., on mountain slopes where otherwise snow-slides, amounting to avalanches, would frequently bury the tracks.

Spur—A stub track diverging from a main or other track, connected by a switch at only one end.

Storage yard—(See Yard.)

Subgrade—Finished surface of roadbed before application of ballast.

Superelevation—The height the outer rail is raised above the inner or grade rail on curves to resist the centrifugal force of moving trains.

Switch—A track structure used to divert rolling equipment from one track to another.

Tender—Vehicle that carries water and fuel for a steam locomotive. Consists of the usual trucks and underframe and is coupled to the locomotive when the locomotive is in service. Tenders are classified according to their fuel and water capacity.

Third rail—Extra rail laid adjacent to track for carrying current for operating an electric locomotive.

Track gage—The distance between the heads of the running rails, measured at right angles thereto at a point five-eighths inch below the top of the rail. Gage of track is referred to as standard, board, and narrow. Standard gage in the United States and some other countries is 56½ inches.

Track length—The length of track or track mileage used as the actual measurement of single, multiple, spur, or yard tracks between defined locations. Thus, 1 mile of railroad may embrace several miles of track.

Tractive effort—That force which the locomotive is capable of exerting at the rail, usually expressed in pounds.

Train density—Number of trains per 24-hour day which can be operated in each direction over a railway line.

Truck—General term for structures which support car body at each end and to which wheels and axles are attached.

Wheel arrangement—The number of wheels or the number of axles that a steam locomotive has is expressed by a series of numerals separated by hyphens; the numerals indicate leading truck, driving truck, and trailing truck, respectively. The figures always describe the locations of the wheels from the front of the locomotive to the rear. For example: a 2-8-2 wheel arrangement means one pair of leading wheels, four pairs of driving wheels, and one pair of trailing wheels.

Wye—Triangular arrangement of tracks used for turning engines, cars, or trains.

Yard—A system of tracks within defined limits—used for making up trains, storing cars, and other purposes—over which movements not authorized by a timetable or train order may be made, subject to prescribed signals and rules or special instructions.

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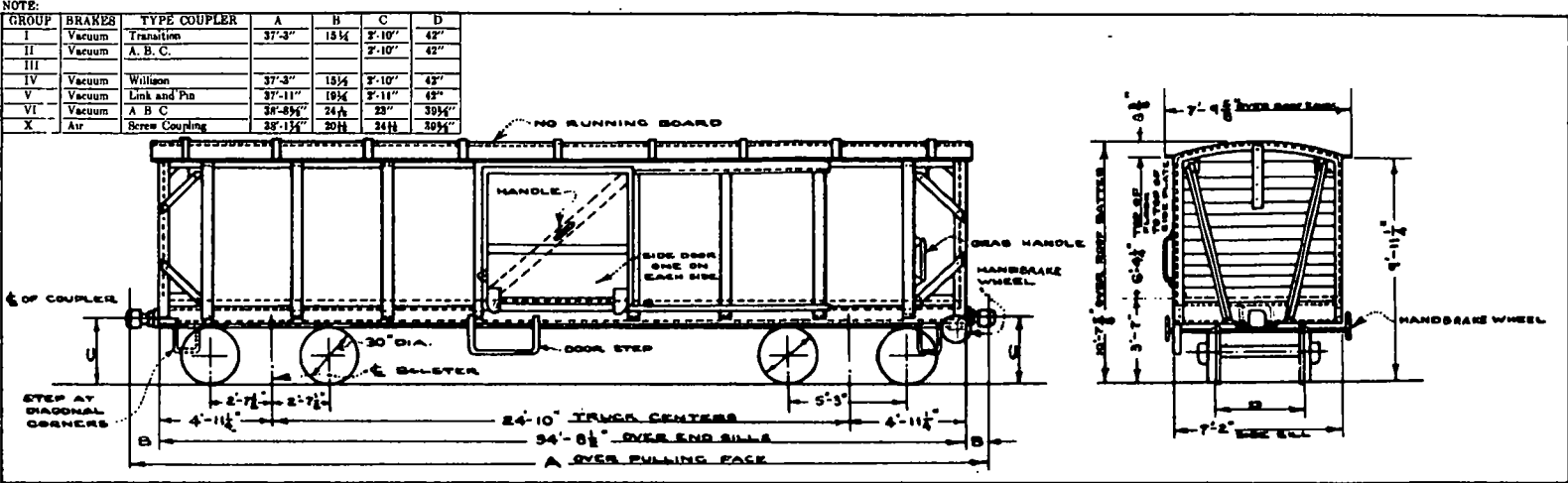
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 Units org under fol TOE:
 55-500 (AC, AD, AE (3) ;
 HA, HB, HC (5) ;
 LA, LB (3))

NG: State AG (3) ; units—same as Active Army except allowance is one copy to each unit.

USAR: Same as Active Army except allowance is one copy to each unit.
 For explanation of abbreviations used see AR 320-50.

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Gage, 39 3/8"
Load limit, 30 tons
Capacity, 1,490 cu ft, 30 tons
Light weight, 31,600 lb
Inside dimensions
Length, 34' 6"
Width, 7' 1"
Height, 6' 1 3/8"
16

Outside dimensions
Overall length over sills, 34' 8 1/2"
Overall length over couplers (see note)
Width at end sills, 7' 2"
Extreme width, 7' 10 3/4"

Door dimensions
Width, 8'
Height, 9' 10"
Overall height from rail
To extreme width, 9' 11 1/4"
To roof, 10' 6 1/2"
Extreme height, 10' 7 5/8"
Number of axles, 4
Wheels, 525 lb, 30", cast iron

Size of journals, 4 1/4 " x 8"
Type of brakes--vacuum, hand, and air
Type of couplers (see note)
Number of doors, 2
Underframe, built-up steel
Center sill, two 12 3/8 " back-to-back channels, each
16
at 31.3 lb per linear ft
Side sill, 9" channel at 13.4 lb per linear ft
End sill, 12" channel at 25 lb per linear ft
Bolster, 3", steel pressing
16
X-bearer, 3", steel pressing
16
Cross tie, 3", steel pressing
16
Side posts, 3" pressed channel
16
Side sheathing, 1/2" plywood, 48" panels
End posts, 3" channels at 5.1 lb per linear ft
End sheathing, 1 1/4", tongued and grooved
Roof, 3/8" plywood, 48 panels
Truck side frame, cast steel (integral journal box)
Side bearing, friction type

Figure 9. Sample report: 30-ton boxcar.

AIRCRAFT CHARACTERISTICS AND INVENTORY						Name of facility 60th Trans Bn (AAM)		Prepared by R. E. Weber, Capt, TC, S2		Headquarters 60th Trans Bn (AAM)		Page number 1		Number of pages 1				
														Key NA - not applicable				
Item number	Type of aircraft	Number and location of each type		Make and model	Number deadlined (aprx)	Avail-ability	Characteristics											Description
							Weight (lb)		Overall dimensions (ft)			Cargo dimensions (in.)						
							Basic	Gross (max)	Length	Width	Height	Height	Doors		Compartment			
1	Fixed wing	35 acft Coord: 4621 Map: 27D		Unk	5	30	3,400	5,000	31	48	11	40	40	48	70	50	52	Conventional, metal, high wing, single engine. Single engine, single main rotor, and antitorque tail rotor. All metal construction.
2	Helicopter	13 acft Coord: 4621 Map: 27D		Unk	3	10	8,300	13,000	66	56	14.5	54	50	35	130	58	68	
Item number	Performance data												Remarks					
	Capacity			External sling cap, max (lb)	Fuel			Takeoff distance w/gross wt (ft)	Speed (mph)	Payload, max (lb)	Cruising range, max (miles)							
	Crew	Passengers*			Grade	Usable cap. (lb)	Consump- tion per hour (lb)											
		Troop seats	Litters															
1	1	5	2	NA	91/96	800	130	1,100	130	800	800	Similar to US L-20A. Similar to US H-34A.						
2	3	17	8	3,900	100/130	1,500	470	490	140	3,200	450							
*Passenger capacity indicates troop seats or litters, depending upon how aircraft is employed.										Date		Typed name and grade						
Additional remarks Information obtained on 3 June 1961 from POW's formerly serving at the location cited.										4 June 1961		John P. Jones, Lt Col						
												Signature						

Figure 21. Aircraft characteristics and inventory.

AIRFIELD CHARACTERISTICS			Name of facility	Prepared by	Headquarters	Page number 1	Number of pages 3
			60th Trans Bn (AAM)	R. E. Weber, Capt, TC, S2	60th Trans Bn (AAM)	Key NA — not applicable	
Item number	Name and location	Type of airfield	Natural and artificial obstructions	Dispersal of aircraft	Maintenance facilities	Access roads	Administrative ground installations (housekeeping)
1	Rothstein Coord: 462713 on Map 12C	Heliport	50-ft obstacle (trees) at each end of both runways	Normal distance between acft in dispersal area is 50 yd	Field maintenance facilities for 40 acft	2 excellent asphalt roads (16 ft wide) from main highway 301	Semipermanent buildings (wooden) provide office, quarters, mess, and recreational facilities for 175 men. Utilities and sanitation facilities excellent. Adequate firefighting equipment, including chemical and water spray.
Item number	Runway and obstruction markers, etc.	Electronic navigation-aids	Fuel and other storage facilities	Runways and taxiways	Loading, unloading, and warmup areas	Date and source of information	Remarks (permanency, diagram of facility, etc.)
1	Wind direction and lighting markers adequate for day or night operation	LF radio homer	Adequate POL storage for 2 day's operation without resupply. No covered storage areas available.	2 runways and 2 taxiways, asphalt construction; runways 900 ft long	Adequate. See attached sketch.	4 June 1961 463d Combat Engrs Reconnaissance Report	Permanent installation. See attached sketch of facility, drawn to scale (incl 1) and clarifying remarks (incl 2).
Additional remarks						Date 4 June 1961	Typed name and grade John P. Jones, Lt Col Signature

Figure 22. Airfield characteristics.

WATERWAY PHYSICAL CHARACTERISTICS - TRANSPORTATION INTELLIGENCE										PAGE NUMBER 1	NUMBER OF PAGES 7
NAME OF FACILITY Barbo Waterway System			PREPARED BY J. K. KEEBLE, Lt Colonel, TC, G2			HEADQUARTERS 115th Transportation Terminal Command (C)		MILE STATION 0.0 LOCATED AT OR NEAR Santa Cristina		KEY NA - Not Applicable	
ITEM	SECTION OF WATERWAY				TYPE OF WATERWAY	CHANNEL CHARACTERISTICS				NAVIGATION SEASON	
	FROM		TO			WIDTH (Ft.)	NORMAL CONTROLLING DEPTH (Ft.)	SAFE DRAFT (Ft.)	NORMAL CURRENT VELOCITY (Mph)	NORMAL OPENING DATE	NORMAL CLOSING DATE
	MILE STATION	NEAREST TOWN	MILE STATION	NEAREST TOWN							
1	0.0	Santa Cristina	36.5	Puerto Del Muerto	Canalized stream	350	8.5	7.0	3.0	1 March	15 December -- ice
ITEM	LOCKS				BRIDGES		SEASONAL INTERRUPTION		DATE AND SOURCE - OF INFORMATION	REMARKS	
	NUMBER	CONTROLLING DIMENSIONS (Ft.)			NUMBER	CONTROLLING CLEARANCE (Ft.)		REASON FOR INTERRUPTION (Floods, Low Water, Freezing, Etc.)			DATE OF INTERRUPTION
		LENGTH	WIDTH	DEPTH OVER SILL		HORIZONTAL	VERTICAL				
1	2	136	21.3	9.0	4	67	19	Hurricanes and accompanying floods	17-20 July 1960	Reconnaissance June 1961 and operational reports 1 July 1960 - 30 June 1961	Navigable by 300-ton barges. Banks revetted with stone in all towns and near bridges
ADDITIONAL REMARKS					DATE 19 July 1961	TYPO NAME AND GRADE R. B. GATZ, Lt Colonel, TC, Adjutant General				SIGNATURE R.B. Gatz	

Figure 24. Waterway physical characteristics.

CHARACTERISTICS OF INLAND WATERWAY PORTS - TRANSPORTATION INTELLIGENCE					NAME OF FACILITY		PREPARED BY		HEADQUARTERS		PAGE NUMBER	NUMBER OF PAGES
					Buena Fortuna River		C. L. DRAKE, Major, TC, S2		5th Transportation Terminal Command (A)		1	10
											KEY	
											NA - Not Applicable	
ITEM NUMBER	MAP REFERENCE NUMBER	NAME AND COORDINATES	APPROACH CHANNEL		HARBOR			WHARFAGE				
			CONTROLLING DEPTH (Ft.)	AVERAGE WIDTH (Ft.)	TYPE	AREA (Acres)	DEPTH (Ft.)	TYPE AND CONSTRUCTION	TOTAL LENGTH (Ft.)	ALONGSIDE DEPTHS (Ft.)		
1	8	Santa Cristina (00°00' N, 00°00' E)	8.5	350						Offshore timber wharf Offshore timber wharf Offshore timber wharf	900 490 400	9 8 7.5
ITEM NUMBER	STORAGE					CRANES		CLEARANCE		DATE AND SOURCE OF INFORMATION	REMARKS	
	WAREHOUSES (1000's of Sq. Ft.)	OPEN (1000's of Sq. Ft.)	BULK GRAIN (1000's of Bushels)	COLD (1000's of Cu. Ft.)	BULK OIL (1000's of Barrels)	TOTAL NUMBER	HEAVIEST LIFT (Tons)	RAIL	HIGHWAY			
1	102	11.6	47.6	23.4	67.3	7	12	0	2	National Waterway Navigation Bureau Re- port, January 1961	Most important port on Buena Fortuna river. Good two-lane concrete road to El Toro, about 20 miles N; fair two-lane macadam road to La Bonita, 30 miles SE. In 1960 port handled 165,000 tons of imports and 213,000 tons of exports.	
ADDITIONAL REMARKS										DATE	TYPED NAME AND GRADE	
										21 June 1961	R. C. HOLT, Major, TC, Adjutant SIGNATURE <i>R. C. Holt</i>	

Figure 26. Characteristics of inland waterway ports.

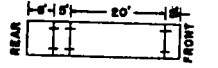
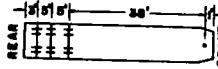
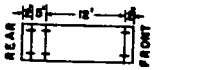
VEHICLE CHARACTERISTICS AND INVENTORY - TRANSPORTATION INTELLIGENCE (Passenger Cars, Buses, Trucks, Animal Drawn Vehicles, Major Items of Road Repair and Maintenance Equipment)			NAME OF FACILITY ALFA National Highways System		PREPARED BY B. B. BOYD, Colonel, TC, OPN S3		HEADQUARTERS HHC 41st Transportation Highway Transport Command		PAGE NUMBER 1		NUMBER OF PAGES 3			
KEY NA - Not Applicable														
A. CONVENTIONAL VEHICLES														
TYPE OF VEHICLE	NUMBER OF EACH TYPE	MAKE	APPROXIMATE NUMBER DEADLINED	CAPACITY (Short Tons) OR NO. OF PASSENGERS	CARGO BED DIMENSIONS	BRAKE OR DEVELOPED ENGINE HORSEPOWER	PRINCIPAL FUEL USED		REMARKS					
Trucks	300,000	Ford, Dodge, GMC	100,000	3/4 to 3	10'x7'x2' (3-ton)	110-150 brake	Gasoline		10 percent dump 50 percent van 50 percent stake and platform 10 percent of these units can be converted to carry 8 stretchers by reducing the seating capacity to 24 persons Dollies are available for 3,000 units The large number of vehicles dead-lined is because of lack of repair parts - most of which must be imported					
	100,000	GMC International, Mack Autocar	15,000	5	14'x7'x7' 14'x7'x3'	170 brake	Gasoline							
Buses	25,000	Autocar	1,000	32 pax	NA	170 brake	Gasoline							
Trailers	5,000	Frehauf	75	25	26'x7'x5'	NA	NA							
Semitrailers	4,500	Frehauf	500	30	31'x7'x5'	NA	NA							
Passenger cars	500,000	Ford, Dodge, Plymouth, Chevrolet, Pontiac	250,000	5 pax	NA	60-150 brake	Gasoline							
B. SPECIAL-PURPOSE VEHICLES														
TYPE OF VEHICLE	NUMBER OF EACH TYPE	MAKE	OVERALL MEASUREMENT			NUMBER OF AXLES, THEIR SPACING, FRONT AND REAR OVERHANG	NO. OF WHEELS	NO. OF DRIVE WHEELS	TIRE SIZE	HORSE-POWER	GROUND CLEARANCE	TURNING RADIUS	CAPACITY AND CUBE	REMARKS
			LENGTH	WIDTH	HEIGHT									
Tank truck	1,000	Autocar	38'	8'	8'		6	4	15.00 x 20	300 brake	18"	55'	5,000 gal.	150 provided with winch
Heavy eqp trans low-bed semi-trailer	500	Hoff	52'	10'	NA		12	NA	16.00 x 21	NA	24"	NA	45 tons	
Truck tractor	800	Autocar	21'	9'	8'		6	4	16.00 x 21	300 brake	24"	80'	30 tons	
ADDITIONAL REMARKS											DATE 30 June 1961		TYPED NAME AND GRADE M. K. LEAR, Lt Colonel, TC, Adjutant, S1 SIGNATURE 	

Figure 27. Vehicle characteristics and inventory.

CHARACTERISTICS OF PORTS AND TERMINAL FACILITIES - TRANSPORTATION INTELLIGENCE			NAME OF FACILITY Dalgo East Coast Ports and Harbors		PREPARED BY R. C. MILLS, Lt Colonel, TC, G2		HEADQUARTERS 115th Transportation Terminal Command		KEY NA - Not Applicable		PAGE NUMBER 5	NUMBER OF PAGES 10		
NAME AND COORDINATES	TYPE OF HARBOR	TIDES AND WEATHER CONDITIONS	NUMBER, TYPE AND LOCATION OF ANCHORAGE ¹	NATURAL AND ARTIFICIAL OBSTRUCTIONS	HARBOR AREA (Acres)	AVERAGE HARBOR DEPTH (Ft.)	MINIMUM CHANNEL DEPTH (Ft.)	WHARVES		COVERED STORAGE CAPACITY				
								TOTAL LENGTH (Ft.)	DEPTH ALONGSIDE (Ft.)	NUMBER AND CLASSIFICATION OF ALONGSIDE BERTHS ²	TRANSIT BERTHS (Sq. Ft.)	WAREHOUSES (Sq. Ft.)	COLD STORAGE (Cu. Ft.)	BULK STORAGE
FERTANN 00 00' N 00 00' E	Improved natural harbor at mouth of East River	MHW interval: 4 hr, 13 min MHW, 23.6' MWN, 19.3' Ice: no hindrance to navigation Fog: prevalent, Dec- Feb	Unlimited anchorage 2 miles beyond mouth of East River Three class II free- swinging berths in harbor Five class II fixed berths at mooring buoys	675-ft N-S breakwater 545-ft E-W breakwater	12	5-15	30 ft to entrance	1,500 2,100 75 1,240	28 21 25 7-10	3 B 4 C 1 T-C 10 F	151,350	257,400	7,500	Grain: 151,000 bu Vegetable oil: 17,000 bbl Coal: 40,000 tons
NAME AND COORDINATES	OPEN STORAGE CAPACITY	MECHANICAL HANDLING FACILITIES	PORT CLEARANCE FACILITIES (Rail, Highway, Inland Waterway, Air) ³	ESTIMATED PORT CAPACITY (Long Tons per 24-hr. Day)		PETROLEUM STORAGE CAPACITY (Bbl.)	REPAIR FACILITIES	NAVAL FACILITIES (Reinforced concrete)	DATE AND SOURCE OF INFORMATION	REMARKS (Bidding, Grading, Underwater Obstructions, Navigation Records, Pilots, Etc.)				
				UNLOADING	CLEARANCE									
FERTANN 00 00' N 00 00' E	9.3 acres adjacent to waterfront 33 acres 3 miles from port on road to MIKE	Thirteen 3½- to 6-ton traveling electric portal cranes One 15-ton traveling electric portal crane Three 6-ton bridge transporters Two 75-ft conveyor belts One 40-ton floating crane	Rail: One double-track standard- gauge line to ALFA, about 35 miles NW. One single-track, meter-gauge line to BRAVO, about 25 miles SW; single-track branch at NOVEMBER to GOLF Highway: Two-lane concrete road, good condition, to ALFA, about 15 miles SE. Two-lane macadam road to MIKE, 20 miles N Water: Via East River to VICTOR, 50 miles E, for 9-ft-draft craft Air: Municipal airport 3 miles from city; runway capable of sup- porting C-47's; one standard gauge railway spur connecting with line at ALFA, 1½ miles from city limits	4,900	6,200	435,000	Two graving docks: 502' x 65' 236' x 47' One floating drydock can accommodate vessel 460' x 53' Three marine railways with maximum cradle length of 311' Major repairs can be made to all vessels not exceeding graving dock length	Portlen Yards— principal supply and repairs base in country	Operations report, 15 April 1961	Vessels entering PORTROT basin are restricted by KRAI lock to length 400', width 50', draft 20'				
CLASSIFICATION OF ANCHORAGE BERTHS			CLASSIFICATION OF ALONGSIDE BERTHS			Include brief summary of air transport facilities which add to port clearance capability				TYPED NAME AND GRADE				
CLASS	MINIMUM DIMENSIONS		TYPE OF VESSEL	GENERAL		TANKER		None			SIGNATURE	DATE		
	DIAMETER (Yds.)	DEPTH (Ft.)		CLASS	LENGTH	DEPTH	CLASS						LENGTH	DEPTH
I	300	28	Capital naval ship or large passenger ship	A	585	21-30	T-A	500	24		R. C. MILLS			
II	300	20	Standard ocean-going cargo vessel	B	430	20-22	T-B	525	23					
III	300	20	Destroyer or small cargo vessel	C	250	21-18	T-C	250	24					
				D	250	17	T-D	257	14					
				E	200	13								
			F	100	7									
Increased dimensions are required for depths exceeding the minimum for each class. Each anchorage should be evaluated in terms of protection from sea and weather.														

Figure 31. Characteristics of ports and terminal facilities.

WAREHOUSE DATA - TRANSPORTATION INTELLIGENCE			NAME OF FACILITY		PREPARED BY		HEADQUARTERS		PAGE NUMBER	NUMBER OF PAGES
			Port of Rusnak		C. R. BRIGGS, Captain, TC, Commanding		760th Transportation Depot Co.		1	4
									KEY	
									NA - Not Applicable	
NAME AND NUMBER OF WAREHOUSE	LOCATION OF WAREHOUSE	OWNER AND OPERATOR	USE	TYPE OF CONSTRUCTION	DIMENSIONS (Ft.)	FLOOR DATA				
						NUMBER OF FLOORS	HEIGHT BETWEEN FLOORS	FLOOR LOAD CAPACITY	TOTAL USABLE FLOOR AREA (Sq. Ft.)	
Customs Building No. 2	South Quay, New Basin	Port Authority	General cargo, imports (transit shed: goods must be cleared within 6 days)	Brick walls, tile roof, stone tile floor	196'x196'	One	16 ft to eavea	600 lb per sq ft	38,400 sq ft	
Weems & Co Warehouse	200 ft S of South Quay, Old Basin	Weems & Co	Building materials	Steel frame, corrugated iron sides and roof, cement floor	Irregular, 155'x245'	One (15 bays)	17.5 ft to eaves	525 lb per sq ft	37,390 sq ft	
Bonded Warehouse No. 1	Southwest Quay, New Basin	Port Authority	General stores	Brick walls, tile roof, cement ground floor, wooden upper floors	100'x160'	Three	Ground floor, 15 ft 1st floor, 14 ft 2nd floor, 12 ft	Ground floor, unlimited 1st floor, 300 lb per sq ft 2nd floor, 205 lb per sq ft	42,653 sq ft	
NAME OR NUMBER OF WAREHOUSE	TOTAL CAPACITY	RAIL CONNECTIONS	ROAD CONNECTIONS	LOADING PLATFORMS	SPECIAL HANDLING EQUIPMENT	FIRE PROTECTION				
Customs Building No. 2	9,500 tons general cargo	Two tracks, front and rear of shed	Paved wharf apron front building; no access to rear and sides because of surface (open) rail tracks	Car floor level platform along entire length of front, 14 ft wide by 2 ft 10 in. high	Eight 2-ton telfera	Grinnell automatic system; fire hydrants, water buckets				
Weems & Co Warehouse	11,000 tons building materials	Two tracks in front of shed	Truck access via 19-ft-wide macadam roadway; 12-ft-wide gravel road skirts building	None	One 2-ton forklift; one 5-ton forklift	Fire hydrants, hand extinguishers				
Bonded Warehouse No. 1	8,100 tons general cargo	One siding in front	Paved apron fronts shed; 24-ft-wide concrete road passes rear of shed	None	Ground floor, four 2-ton telfers 1st floor, two 2-ton telfers 2nd floor, two 1-ton pivoting wall cranes	Grinnell automatic system; sand and water buckets				
REMARKS						DATE	TYPE NAME AND GRADE			
						22 June 1961	C. R. BRIGGS, Captain, TC, Commanding			
						SIGNATURE C. R. Briggs				

Figure 35. Warehouse data.

RAILROAD LINE CHARACTERISTICS & FACILITIES - TRANSPORTATION INTELLIGENCE										NAME OF FACILITY				PREPARED BY				HEADQUARTERS				PAGE NUMBER		NUMBER OF PAGES	
										Shiloh National Railways				M. B. YOKES, Colonel, TC, G2				2nd GHQ, Trana Railway Service				1		5	
																						KEY			
																						NA - Not Applicable			
RAIL LINE NUMBER	TERMINALS BY DIVISIONS	ROUTE MILES			TOTAL TRACK MILES	RULING GRADE (Percent)		MINIMUM RADIUS OF CURVATURE (Feet)	AXLE LOAD LIMIT (Short Tons)	RAILS		BALLAST			TIES			BRIDGES		TUNNELS					
		SINGLE	DOUBLE	TOTAL		GOING	RETURNING			WEIGHT (Lbs. per Yd.)	LENGTH (Ft.)	TYPE	SIZE (Diameter)	DEPTH (In.)	TYPE	SIZE	SPACING (Per Mile)	NUMBER	TOTAL LENGTH (Feet)	NUMBER	TOTAL LENGTH				
1	Louisville-Clagg	0.0	25.6	25.6	68.7	1.6	1.4	955	30.0	131	33	Gravel	NA	9	Untreated oak	6"x8"x8' 6"	2,880	4	350	0	NA				
	Clagg-Boyd	56.2	0.0	56.2	75.4	1.0	0.8	1,433	30.0			Broken stone	2½"	9	Treated pine		2,880	7	935	1	2,875				
2	Seymour-Reed	43.8	0.0	43.8	57.6	1.2	1.5	1,146	30.0	133	39	Broken stone	2½"	12			2,880	6	550	0	NA				
	Reed-Dale	39.4	6.3	45.7	64.8		1.3	1,433	30.0	133	39	Broken stone	2½"	12	Untreated oak	6"x8"x8' 6"	2,880	2	180	0	NA				
RAIL LINE NUMBER	PASSING TRACKS		CLASSIFICATION YARDS		FUELING FACILITIES		WATERING FACILITIES			REPAIR SHOPS			SIGNALS AND TRAIN CONTROL	TRAIN DISPATCHING	TYPE OF MOTIVE POWER	AVERAGE NUMBER OF TRAINS EACH WAY PER 24 HOURS									
	MAXIMUM DISTANCE (Miles)	MINIMUM LENGTH (Feet)	LOCATION	CAPACITY (Cars per 24 Hours)	LOCATION	TYPE	LOCATION	SOURCE	CAPACITY	LOCATION	TYPE	CAPACITY				FREIGHT	PASSENGER								
1	16.3	1,150	Louisville	5,000	Louisville	Coaling trestle	Louisville	City supply	100,000 gal. per day	Louisville	Locomotives and freight cars	12 locos 45 cars	Manual blocking with semaphore signals	Telephone from Louisville	Steam	17	5								
2	5.4	1,650	None	NA	Boyd	Hand shoveling	Boyd	City supply	2,000 gal. per hr	None	NA	NA	Do	Do	Do	7	5								
	6.8	1,650	Seymour	3,500	Seymour	Coaling trestle	Seymour	City supply	3,000 gal. per hr	None	NA	NA	Automatic blocking with position lights	Telephone from Seymour	Do	8	6								
	4.7	1,340	Dale		Dale	Coaling trestle	Dale	Pumped from river City supply	50,000 gal. per day 40,000 gal. per day	Dale	Locomotives and freight cars	15 locos 50 cars	Do	Do	Do	8	6								
REMARKS													DATE	TYPED NAME AND GRADE											
													30 June 1961	J. K. NOKES, Lt Colonel, TC, Adjutant											
													SIGNATURE												
													<i>J. K. Nokes</i>												

Figure 36. Railroad line characteristics and facilities.

LOCOMOTIVE CHARACTERISTICS AND INVENTORY - TRANSPORTATION INTELLIGENCE							NAME OF FACILITY			PREPARED BY					HEADQUARTERS					PAGE NUMBER		NUMBER OF SHEETS	
							Shiloh National Railways			T. L. MAPES, Colonel, TC, G2					1st GHQ Trans Railway Service					2		3	
																				KEY			
																				NA - Not Applicable			
SERIES NUMBER	WHEEL ARRANGEMENT	NUMBER IN SERVICE	MANUFACTURER	YEAR BUILT	TRACTION EFFORT (Lbs.)	ADHESIVE WEIGHT (Short Tons)	TOTAL WEIGHT OF ENGINE AND TENDER IN WORKING ORDER (Short Tons)	MAXIMUM AXLE LOAD (Short Tons)	DIAMETER OF DRIVING WHEEL (In.)	CYLINDERS			BOILER PRESSURE (Lbs./Sq. In.)	DRIVING WHEEL BASE (Ft. & In.)	TOTAL WHEEL BASE OF ENGINE & TENDER (Ft. & In.)	TOTAL LENGTH OF ENGINE & TENDER (Ft. & In.)	TENDER CAPACITIES			REMARKS			
										NUMBER	DIAMETER (In.)	STROKE (In.)					WATER (Gals.)	COAL (Short Tons)	OIL (Gals.)				
A1	2-8-4	65	Lima	1926	69,800	124.75	293.8	32.5	63"	2	28	30	220	16' 6"	75' 8 1/2"	87' 1 1/2"	9,600	16	NA	Steam			
H5	2-8-2	323	Lima	1938	48,570	107.75	217.25	26.9	63"	2	25	32	180	16' 6"	67' 4 1/2"	77' 8 1/2"	8,000	12	NA	Do			
I40	4-6-2	3	American Locomotive Co	1932	20,810	47.9	159.7	24.0	69"	2	19	26	180	7' 0"	58' 5 5/8"	67' 10 1/8"	7,500	14	NA	Do			
KJ	4-6-2	16	Do	1921	28,520	77.5	199.15	25.8	75"	2	22	26	200	13' 0"	65' 1 1/2"	74' 8 7/8"	8,000	13 1/2	NA	Do			
ML	0-10-0	3	Do	1933	55,360	138.5	213.45	29.5	52"	2	24	28	210	19' 0"	54' 7 1/2"	69' 10 1/2"	8,000	12	NA	Do			
S1	4-8-4	20	Do	1940	62,400	137.5	445.5	34.4	79"	2	25	32	290	20' 6"	97' 2 1/2"	115' 5 9/16"	18,000	46	NA	Do			
A4	0-6-6-0	18	Do	1950	45,000	107.0	107.0	28.0	40"	8	8	10	NA	11' 4"	41' 1"	56' 6"	200	NA	800	Diesel-electric			
B6	0-4-4-0	22	Besler Co	1955	48,000	80.8	80.8	21.2	40"	8	6	8	NA	6' 10"	33' 6"	49' 2"	135	NA	750	Do			
D2	0-4-0	16	GE	1953	15,000	25.0	25.0	12.5	33"	6	5	6	NA	NA	6' 1"	18' 2"	11	NA	75	Do			
E4	0-4-0	29	Lima	1956	15,000	25.0	25.0	12.5	28"	6	5	6	NA	6' 1"	6' 1"	18' 2"	14	NA	75	Diesel-mech			
ADDITIONAL REMARKS															DATE		TYPED NAME AND GRADE						
See attached sheets for further details.															15 June 1961		J. T. MILLER, Major, TC, Adjutant						
																	SIGNATURE						
																	J. T. Miller						

Figure 37. Locomotive characteristics and inventory.

3000017509

